Kamas Point

Timber Sale
Environmental Assessment

November 2012
Montana Department of Natural Resources and Conservation
Southwestern Land Office
Missoula Unit

FINDING
KAMAS POINT TIMBER SALE

An interdisciplinary team (ID Team) has completed the Environmental Assessment (EA) for the Kamas Point Timber Sale prepared by the Montana Department of Natural Resources and Conservation (DNRC). After review of the EA, project file, public correspondence, Department Administrative Rules, policies, the DNRC's Habitat Conservation Plan and the State Forest Land Management Plan (SFLMP), I have made the following decisions:

1. ALTERNATIVE SELECTED

Two alternatives were presented and the effects of each alternative were fully analyzed in the EA:

1. The No Action Alternative
2. The Action Alternative

The Action Alternative proposes to harvest approximately 2-3 million board feet (MMBF) of timber on 370 acres. The No Action Alternative does not include the harvest of any timber. Subsequent review determined that the alternatives, as presented, constituted a reasonable range of potential activities.

For the following reasons, I have selected the Action Alternative without additional modifications:

a) The Action Alternative meets the Project Need and the specific Objectives of the Proposed Action (Desired Outcomes and Conditions) as described on pages 1-1 and 1-2 of the EA. The Action Alternative would produce an estimated $100,000-$150,000 ($50/MBF) return to the Common School (CS) Trust, while providing a mechanism whereby the existing timber stands would be moved towards conditions more like those which existed historically.

b) The analysis of identified issues did not disclose any reason compelling the DNRC to not implement the timber sale.

c) The Action Alternative includes mitigation activities to address environmental concerns identified during both the Public Scoping phase and the project analysis.

2. SIGNIFICANCE OF IMPACTS

For the following reasons, I find that implementing the Action Alternative will not have significant impacts on the human environment:

a) **Water Quality –** There would be a low risk of direct or indirect impacts to water quality or downslope beneficial uses within the watershed. There is very low risk of cumulative impacts to water quality or beneficial uses from increases in water yield or sediment delivery. Water Quality Best Management Practices for Montana Forests (BMPs) and the Streamside Management Zone (SMZ) law will be strictly adhered to during all operations involved with the implementation of the Action Alternative.

b) **Cumulative Watershed Effects –** Estimated increases in annual water yield for the proposed action has been determined to be negligible by the DNRC Hydrologist. Increases in sediment yield are expected to be negligible due to the amount of area treated, location along the landscape, replacement and/or improvement of existing culverts and mitigations designed to minimize erosion.

c) **Geology/Soil Resources –** With the implementation of BMPs and the recommended mitigation measures, the proposed harvest operations present a low risk of detrimental impacts to soils. Existing roads would be improved to meet BMPs. Leaving 5 – 15 tons of large, woody debris on site will provide for long-term soil productivity. Harvest mitigation measures such as skid trail planning and season of use limitations will limit the potential for severe soil impacts

d) **Cold Water Fisheries –** Implementation of the SMZ Law and Rules, Best Management Practices and site-specific recommendations of the DNRC Soil Scientist and Hydrologists would minimize impacts to downstream perennial stream channels.

e) **Noxious Weeds –** Equipment will be cleaned prior to entering the project area, which will reduce the likelihood of weed seeds being introduced onto treated areas. The DNRC will monitor the project area for two years after harvest and will use an Integrated Weed Management strategy to control weed infestations should they occur.

f) **Forest Conditions and Forest Health –** Implementation of the Action Alternative would alter stand conditions towards those which were more common historically. The remaining stands would likely emulate those conditions which existed prior to European settlement, with seral species dominant. Many of the large ponderosa pine and western larch would likely have survived the mixed severity fires which were common in these forest types, and be represented in the forest much as they will be following treatment. Many of the smaller encroaching Douglas fir will be removed and the forest will approach the seral species mix of a more natural condition. Stand productivity would also be expected to increase.

g) **Air Quality** – Full compliance with applicable air quality laws would be achieved by securing approval from the Montana-Idaho state airshed group prior to any burning operations. Burning associated with slash disposal would only be done on days with good to excellent smoke dispersion.

h) **Visual Quality** – Reduced stocking levels, fresh slash and skid trails could affect the appearance of the project area. Following treatment, all stands would have a more open appearance.

i) **Wildlife** – The proposed harvest operations present a minimal likelihood of negative impacts to Threatened and Endangered Species. Those potential impacts that do exist have been mitigated to levels within acceptable thresholds. The same is true for those species that have been identified as "sensitive" by the DNRC. The effects of the proposed action on Big Game species would be low due to habitat not being a limiting factor in the project area.

3. PRECEDENT SETTING AND CUMULATIVE IMPACTS

The project area is located on State- owned lands, which are "principally valuable for the timber that is on them or for growing timber or for watershed" (**MCA 77-1-402**). The proposed action is similar to past projects that have occurred in the area. Since the EA does not identify future actions that are new or unusual, the proposed timber harvest is not setting precedence for a future action with significant impacts.

Taken individually and cumulatively, the identified impacts of the proposed timber sale are within established threshold limits. Proposed timber sale activities are common practices and none of the project activities are being conducted on fragile or unique sites.

The proposed timber sale conforms to the management philosophy adopted by DNRC and is in compliance with existing laws, policies, guidelines, and standards applicable to this type of action.

4. SHOULD DNRC PREPARE AN ENVIRONMENTAL IMPACT STATEMENT (EIS)?

Based on the following, I find that an EIS does not need to be prepared:

a) The EA adequately addressed the issues identified during project development, and displayed the information needed to make the pertinent decisions.

b) Evaluation of the potential impacts of the proposed timber sale indicates that significant impacts to the human

environment will not occur as a result of the implementation of The Action Alternative.

c) The ID Team provided opportunities for public review and comment during project development and analysis.

_\s\ Jonathan Hansen_____
Jonathan Hansen
Missoula Unit Manager-Decision Maker
__March 11, 2013_____
DATE

Cover Sheet: Kamas Point Timber Sale Environmental Assessment

Proposed Action: The Montana Department of Natural Resources and Conservation (DNRC) proposes to harvest approximately 14,000-21,000 tons (2-3 million board feet) of saw timber on approximately 370 acres, within Section 16, T 12 N, R 16 W (State School Trust Lands). The proposed Timber Sale activities may begin as early as June 2013. Activities associated with Proposed Project would include the contracted: harvest of timber, construction of new roads and maintaining and improving existing roads. The Contract Term would likely be three years; although the burning of slash and post harvest weed spraying activities may not be completed until 2016. These dates are approximate.

Type of document: Environmental Assessment

Lead agency: Montana Department of Natural Resources and Conservation (DNRC)

Responsible Official (Decision Maker):
Jonathan Hansen
Missoula Unit DNRC
3206 Maverick Lane,
Missoula, MT 59804
(406) 542-4309
jehansen@mt.gov

For further information Contact (Project Leader):
Richard Stocker
Missoula Unit DNRC
3206 Maverick Lane,
Missoula, MT 59804
(406) 542-5810
rstocker@mt.gov

Special Note: Comments received in response to this Environmental Assessment will be available for public inspection and will be released in their entirety if requested pursuant to the Montana Constitution.

How to Read this Environmental Assessment (EA)

To read this EA more effectively, carefully study this page. In accordance with Montana State Regulations we have designed and written this EA (1) to provide the Project Decision Maker with sufficient information to make an informed, reasoned decision concerning the Proposed Kamas Point Timber Sale and (2) to inform members of the affected and interested public of this project so that they may express their opinions to the Project Decision Maker.

This EA follows the organization and content established by the Environmental Quality Council (EQC) in Administrative Rules of Montana (ARM 36.2.521-36.2.543). The EA consists of the following chapters:

1.0 Purpose and Need for Action
2.0 Alternatives, Including the Proposed Action
3.0 Affected Environment
4.0 Environmental Consequences
5.0 List of Preparers
6.0 List of Agencies and Persons Consulted
7.0 References

Chapters 1 and 2 together serve as an Executive Summary. It is the intention that the reader will understand the proposal and the potential environmental, technical, economic, and social consequences of the proposed Action and the No-Action Alternative.

- **Chapter 1** introduces the Kamas Point Timber Sale. It provides a very brief description of the proposed project and goes on to explain the following three aspects:
  (1) The relevant environmental issues.
  (2) The decisions to be made.
  (3) The relevant laws, rules and regulations with which the DNRC must comply.

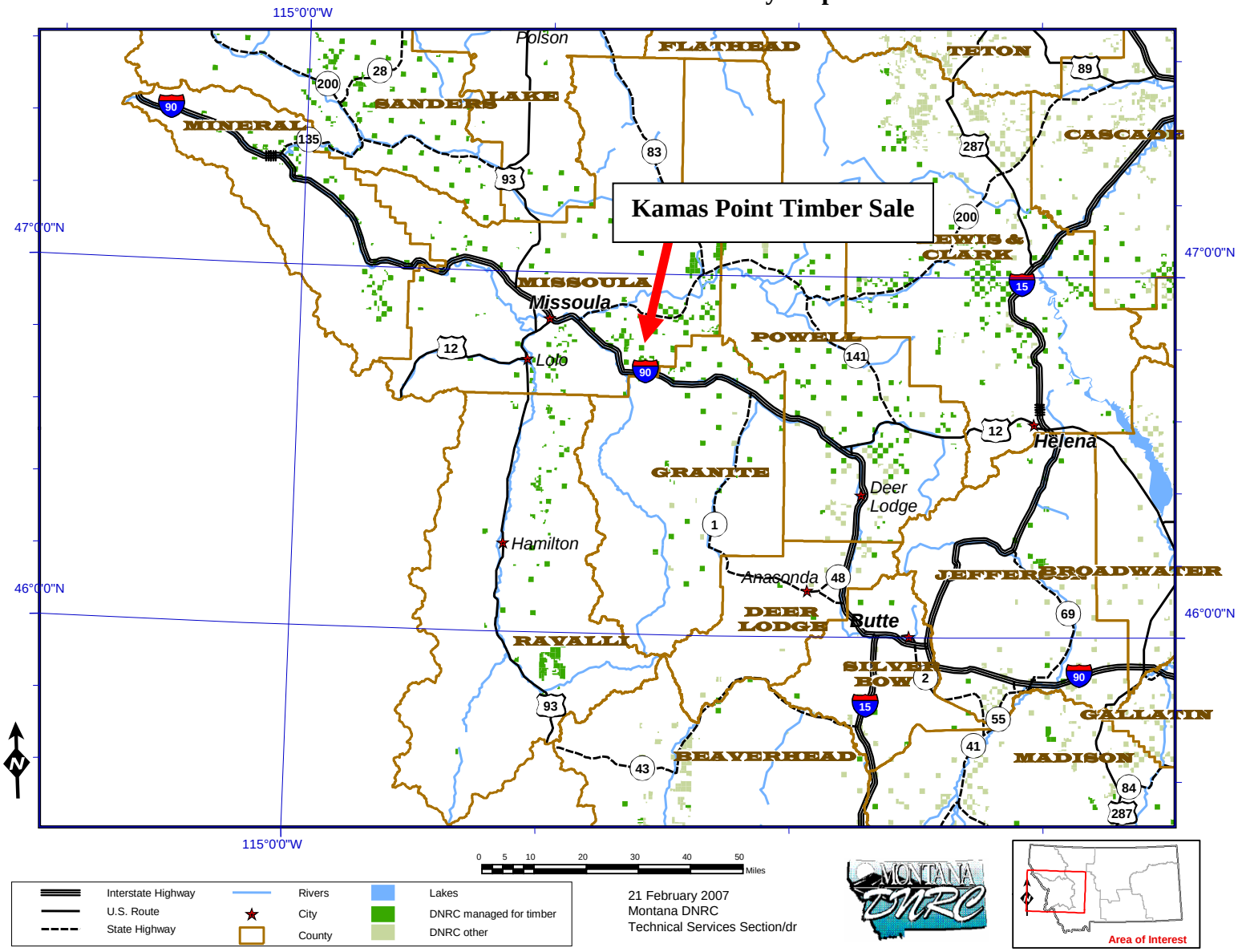
- **Chapter 2** provides detailed descriptions of Alternative A: No Action and Alternative B: Harvest. It includes a summary comparison of the predicted effects of these two alternatives on the human environment. The intent of this chapter is to provide a basis for choice between the two alternatives.

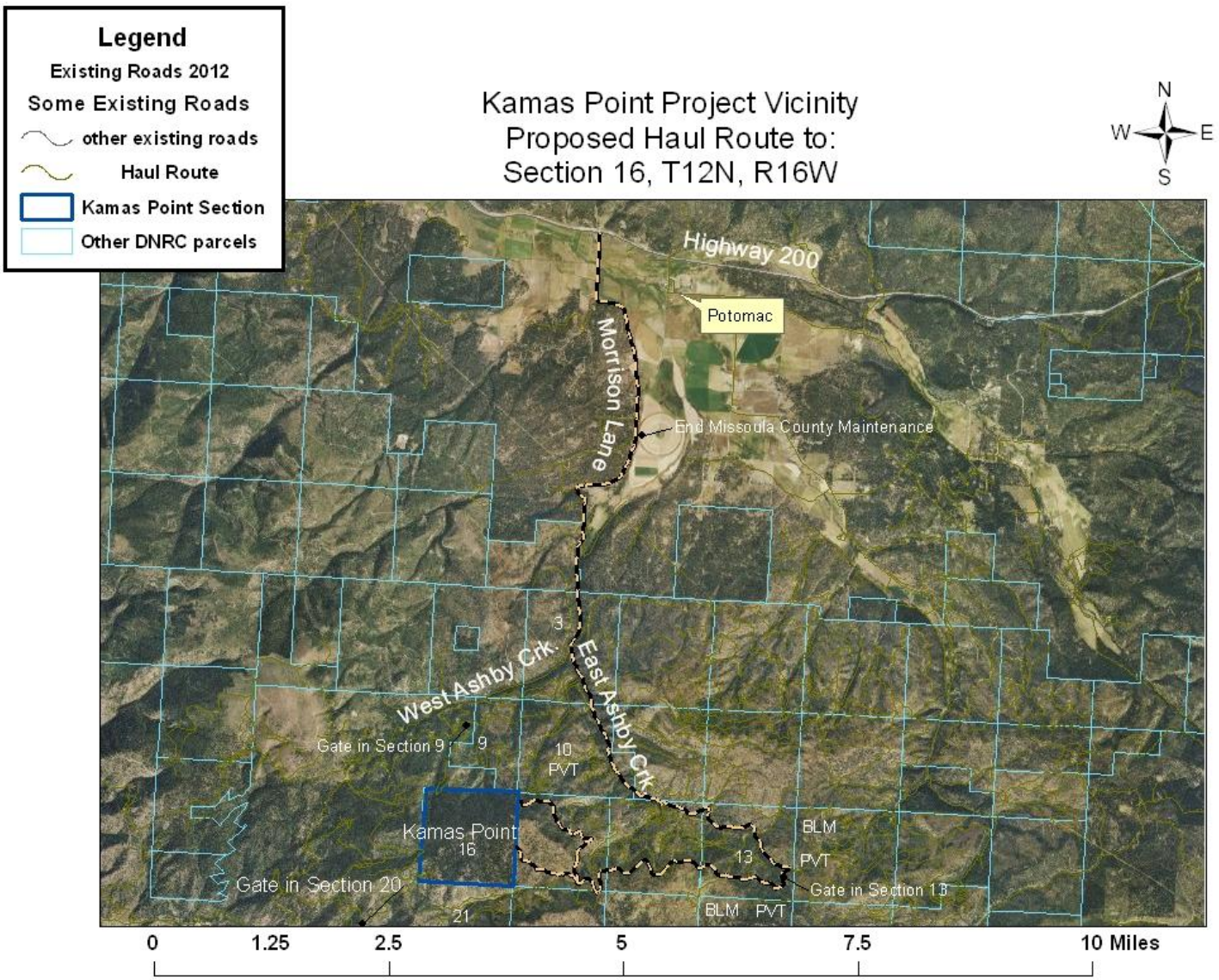
- **Chapter 3** briefly describes the past and the existing conditions with respect to the relevant resources (*issues*) that would be meaningfully affected. The intention is to establish a baseline, facilitating a comparison of the alternatives with respect to the predicted effects.

- **Chapter 4** presents the detailed, analytic predictions of the consequences of implementing Alternative A: No Action and Alternative B: Harvest. The predictions include the direct, indirect, short term, long term, irreversible, irretrievable, and cumulative effects of implementing the alternatives.

TABLE OF CONTENTS

Kamas Point Timber Sale Vicinity Map





Map by: R. Stocker, DNRC, 3-2012

1.0 Chapter 1: Purpose of and Need for Action

1.1 Proposed Action: Harvest

The Montana Department of Natural Resources and Conservation (DNRC) proposes to harvest timber from the Kamas Point Section 16, T12N, R16W. Implementation of the Action Alternative would yield approximately 14,000-21,000 tons (2-3 million board feet) of timber from approximately 370 acres. This would generate revenue for the benefit of the Common School (CS) grant. The proposed action may be implemented as early as June 2013 and may be completed by 2016. The burning of slash and weed spraying activities may be finished by 2016. These dates are approximate.

1.2 Location

The proposed timber harvest would occur within Section 16, T12 N, R 16 W (herein referred to as the Project Section), Missoula County; approximately 18 miles east south east of Missoula, Montana, and approximately 6 miles south of Potomac (illustrated by map on preceding page).

1.3 Need for the Action

The lands involved in this proposed project are held by the State of Montana in trust for the support of specific beneficiary institutions. These include public schools, state colleges and universities, and other specific state institutions such as the School for the Deaf and Blind (Enabling Act, February 22, 1889; 1972 Montana Constitution, Article X, Section 11). The Board of Land Commissioners and Department of Natural Resources and Conservation (DNRC) are required by law to administer these Trust Lands to produce the largest measure of reasonable and legitimate advantage over the long run for these beneficiary institutions (Section 77-1-202, MCA).

1.4 Project Objectives

In order to meet the goals of the management philosophy adopted through programmatic review of the State Land Forest Management Plan (SLFMP) DNRC, 1996, governed by the Administrative Rules for Forest Management (ARM 33.11.401 through 471), and conservation commitments specified within the Selected Alternative of the Final Environmental Impact Statement of the Montana Forested State Trust Lands Habitat Conservation Plan (HCP) the Department has set the following specific project objectives:

- Generate a reasonable and legitimate amount of revenue for the Common School Trust Grant by harvesting approximately 14,000-21,000 tons (2-3 million board feet) of timber.
- Promote forest health and vigor of timber stands and subsequently help prevent and/or decrease the incidence of insect and disease infestations.
- Improve tree growth, promote younger age classes and regenerate portions of stands (create new age class).

- Maintain and/or promote attributes of biologically diverse forests (including Desired Future Conditions 36.11.405 ARM) and critical elements and habitats with respect to Threatened and Endangered Species; and where not at odds with Trust Mandates and ARM, sensitive wildlife and plant species.

1.5 Decisions to be made

- Determine if the proposed alternatives meet the project objectives.
- Determine which alternative should be selected.
- Determine if the selected alternative would cause significant impact(s) to the Human Environment, requiring the preparation of an Environmental Impact Statement (EIS).

1.6 Relationship to the State Forest Land Management Plan, Administrative Rules and Habitat Conservation Plan

State Forest Land Management Plan:
In 1996, the Land Board approved the Record of Decision (ROD) for the State Forest Land Management Plan (SFLMP). The SFLMP provides the philosophical basis, consistent policy, technical rationale, and guidance for the management of forested State Trust Lands.

Administrative Rules for Forest Management:
In 2003, DNRC adopted the Administrative Rules for Forest Management (Forest Management Rules; ARM 36.11.401 through 471). The Forest Management Rules are the specific legal resource management standards and measures under which DNRC implements the SFLMP and subsequently its forest management program.

Habitat Conservation Plan:
In December 2011, the Land Board approved the Record of Decision (ROD) for the Montana Forested State Trust Lands Habitat Conservation Plan (HCP). Approval of the ROD was followed by the issuance of an Incidental Take Permit (Permit) by the U.S. Fish and Wildlife Service (USFWS). The HCP is a required component of an application for a Permit which may be issued by the U.S. Fish and Wildlife Service or National Marine Fisheries Service to state agencies or private citizens in situations where otherwise lawful activities might result in the incidental take of federally-listed species. The HCP is the plan under which DNRC intends to conduct forest management activities on select forested state trust lands while implementing specific mitigation requirements for managing the habitats of: grizzly bear, Canada lynx, and three fish species: bull trout, westslope cutthroat trout, and Columbia redband trout.

Project Section Management:
The DNRC would manage lands involved in this project in accordance with the State Forest Land Management Plan (DNRC 1996), the Administrative Rules for Forest Management (ARM 36.11.401 through 471) and conservation commitments contained in the Selected Alternative in the Final EIS of the Montana Forested State Trust Lands Habitat Conservation Plan (HCP), as well as other applicable state and federal laws.

1.7 History of the Planning and Scoping Process - Public Involvement: Agencies, Individuals and Groups Contacted

Comments from the general public, interest groups and agency specialists (DNRC) were solicited in May, 2011. A newspaper legal notice was run in the Missoulian, on May 29 to June 5 of 2011. Scoping notices were sent to 37 individuals and/or organizations (a list of the organizations/individuals contacted is available in the project file). The Scoping Notice was also made available on the DNRC website. The Scoping Notice was distributed internally (DNRC) as well. Scoping notices were mailed to adjacent landowners and residents along the Proposed Haul Route: Morrison Lane and the existing road up Ashby and East Ashby Creek.

The Tribal Preservation Office of the Confederated Salish and Kootenai Tribes expressed concern about protection of any cultural resources. Several residents along Morrison Lane expressed concerns about road use issues: safety, dust, maintenance and repairs. Several individuals expressed concern that continued timber harvest (within affected drainages) could negatively impact forest cover important to elk and deer; and that mature forest cover existing within the Project Section is unique and rare.

The following resource specialists were involved in the project design, assessment of potential impacts, and development of mitigation measures: Garrett Schairer - Wildlife Biologist, DNRC, South Western Land Office (SWLO); Gary Frank- Hydrologist, DNRC, Forest Management Bureau (FMB); Patrick Rennie - Archeologist, Agriculture and Grazing Management Bureau (AGMB), DNRC, Helena; Jonathan Hansen-Decision Maker/ Unit Manager, Missoula Unit, DNRC; Richard Stocker-Project Leader/ Forester, Missoula Unit, DNRC.

1.8 Other environmental assessments (EAs) or projects related to this project

Other DNRC EAs and Proposals: Ryan Gulch Salvage Timber Sale EA 2000. Cramer Creek Timber Sale EA 2002. Turah Creek Timber Sale EA 2002. Elk 36 Timber Sale EA 2002. Dirty Ike Salvage Timber Sale EA 2003. Lost Bear Timber Sale EA 2003. Tyler Creek Timber Sale EA 2005. Dry Bear Mouth Timber Sale EA 2005. Headquarters Timber Sale EA 2005. Hay Wire Wallace Timber Sale EA 2006. The Lolo Land Exchange, between DNRC and US Forest Service 2006. Packer Gulch Fire Salvage Supplemental EA 2006. Confusion Salvage EA 2006. Hidden Bug Salvage EA 2007. Bugchuck Salvage EA 2008. Montana Legacy Project 2008 (land sale from Plum Creek Timber Company to The Nature Conservancy and subsequently to DNRC 2010). Shoup-Jones Timber Sale EA 2010. Clearwater Flats Timber Sale EA 2010. Squirrel Tail Timber Sale EA 2010. Washoe Creek Timber Sale EA 2011. McNamara Landing Timber Sale EA 2012. The following site provides a searchable index of Montana Environmental Policy Act (MEPA) documents submitted to the Environmental Quality Council (EQC): http://leg.mt.gov/css/Publications/MEPA/mepa.asp

MEPA Documents (other than those listed above) submitted to EQC for Projects affecting areas located within Missoula, Granite and Powell Counties may be relevant.

DNRC's Ashby Creek Road Relocation Project:
In June of 2012 the DNRC began relocating a portion of the road along Ashby Creek located in Section 3, T12N, R16W (see map preceding Chap 1), completion of this project is expected in 2013. The relocation of Ashby Creek Road involves replacing the segment from the Fork of East and West Ashby Creek to a point approximately ½ mile downstream. In conjunction with the Road Relocation Project; plans include installation of a bridge at the junction of the East and West Forks of Ashby Creek, and removing the existing culvert at this location. Additionally, two culverts: in-stream crossings of Ashby Creek below the junction would be removed, as part of the reclamation of the Ashby Creek Road segment that is being replaced. Removing these culverts would restore stream function (important to fish) and alleviate the problem of water overflowing the inlet of one of these culverts and running down the existing road. Reclamation of the existing road segment (once the new road segment is constructed) would decrease sediment delivery to Ashby Creek long term. All of the **Road Relocation Project activities being conducted are independent of the proposed Kamas Point Timber Sale activities.** The new road segment under construction would be used as part of the Proposed Haul Route for the Kamas Point Timber Sale.

1.9 Permits, Licenses, and Other Authorizations Required:

1.9.1 124 Permit

A Stream Protection Act Permit (124 Permit) is required from the Department of Fish, Wildlife and Parks (DFWP) for activities that may affect the natural shape and form of a stream's channel, banks, or tributaries. A 124 Permit would be required to reconstruct portions of the existing road along East Ashby Creek and construction of a creek crossing across a tributary of Wallace Creek (within the Project Section).

1.9.2 Montana/Idaho Airshed Group

DNRC is a member of the Montana/Idaho Airshed Group, which aims to minimize impacts from smoke generated by burning activities related to forest management. This is achieved by coordination between the group's members. As a member of the Airshed Group, the DNRC agrees to burn only on days that are approved for good smoke dispersion, as determined by the Smoke Management Unit in Missoula, Montana.

1.9.3 Habitat Conservation Plan- Incidental Take Permit

In December 2011, the U.S. Fish and Wildlife Service issued an Incidental Take Permit under Section 10 of the Endangered Species Act. The Permit applies to select forest management activities affecting the habitat of grizzly bear, Canada lynx, and three fish species: bull trout, westslope cutthroat trout, and Columbia redband trout, on project area lands covered

under the HCP. DNRC and the USFWS will coordinate monitoring of certain aspects of the conservation commitments to ensure program compliance with the HCP.

1.10 Issues

The following issues were identified during the scoping process. They constitute the basis for the formation of project specifications, development of mitigation measures, and assessment of environmental impacts.

1.10.1 Issues Studied in Detail:

1.10.1.1 Water:

1.10.1.1.1 Water Quality

There is concern that timber harvest activities may cause impacts to water quality as a result of increased erosion and sediment delivery to streams.

1.10.1.1.2 Water Yield

There is concern that timber harvest activities may affect the timing, distribution and amount of water yield. Increased water yield may affect stream channel stability, form and function.

1.10.1.1.3 Cumulative Watershed Effects

There is concern that the Proposed Timber Harvest activities in combination with past forest management activities may contribute to cumulative watershed impacts within affected watersheds.

1.10.1.2 Geology/ Soil Resources

There is concern that timber harvest activities may affect soils and site productivity long term. Timber harvest activities may impact soils through displacement and compaction of soils. Timber harvest, through removal of or displacement of organic materials, could reduce available nutrients, impair nutrient recycling and increase soil displacement.

1.10.1.3 Cold Water Fisheries

There is a concern that timber harvest activities may impact fisheries by increasing: water yield, sediment delivery to streams, and/or modifications to stream channel form and function. Ashby and East Ashby Creeks are westslope cutthroat trout streams.

1.10.1.4 Noxious Weeds

There is a concern that timber harvest activities may introduce or spread noxious weeds.

1.10.1.5 Forest Vegetation

There is concern that timber harvest activities may affect forest cover: including types and their distributions. Harvest of large diameter trees may negatively impact Old Growth Stands (as defined by Green et. al. 1992 and adopted in ARM).

1.10.1.6 Air Quality

There is concern that timber harvest activities, including burning slash and road use may affect local air quality.

1.10.1.7 Recreational Use

There is concern that timber harvest activities may affect recreation opportunities within the area.

1.10.1.8 Economic Benefits and Project Revenue

What revenue would this project would provide to the trust beneficiaries?

1.10.1.9 Visual Quality

There is concern that timber harvest and road construction may affect the visible landscape.

1.10.1.10 Wildlife Issues Analyzed:

1.10.1.10.1 Mature Forested Habitats and Landscape Connectivity

There is concern that timber harvest activities may alter mature forested habitats and landscape connectivity, which may affect species that rely on these mature forested habitats, and/or alter connectivity and the ability of wildlife requiring corridors to move through the landscape.

1.10.1.10.2 Grizzly Bears

There is concern that timber harvest activities may alter cover, increase access, and reduce secure areas, which may affect grizzly bears by displacing them from important habitats and/or increasing risk to bears of human-caused mortality.

1.10.1.10.3 Lynx Habitat

There is concern that timber harvest activities may negatively affect Canada lynx by altering lynx summer foraging habitat, winter foraging habitat, and other suitable habitat, rendering it unsuitable for supporting lynx.

1.10.1.10.4 Fisher

There is concern that timber harvest activities may reduce the amount and/or quality of fisher habitats, which may alter fisher use of the area.

1.10.1.10.5 Flammulated Owl

There is concern that timber harvest activities may alter flammulated owl habitat by reducing canopy closure and increasing tree spacing, and may remove snags needed by flammulated owls for nesting.

1.10.1.10.6 Pileated Woodpecker

There is concern that timber harvest activities may reduce suitable nesting and foraging habitat for pileated woodpeckers, which may alter pileated woodpecker use of the area.

1.10.1.10.7 Big Game Winter Range

There is concern that timber harvest activities may remove forest cover on big game winter range, which may reduce the carrying capacity of the winter range.

1.10.1.10.8 Elk Security Cover

There is concern that timber harvest activities may remove elk security cover, which may affect hunter opportunity and local quality of recreational hunting.

1.10.2 Issues Eliminated from Further Study

1.10.2.1 Other Species of Concern:

The following species were considered but eliminated from detailed study due to lack of habitat present: Bald Eagle, Black-backed woodpecker, Coeur d'Alene Salamander, Columbian Sharp-tailed Grouse, Common Loon, Harlequin Duck, Gray Wolf, Mountain Plover, Northern Bog Lemming, Peregrine Falcon, and Townsend's Big-eared Bat. Thus there would be a low risk of adverse direct, indirect, or cumulative effects as a result of either alternative.

1.10.2.2 Other Sensitive or Rare Plants and Animals

The Montana Natural Heritage Program (MTNHP) database was researched for other plant and animal species of concern.
None are known to exist within the Project Area nor would any be affected as a result of implementation of the project.
The MTNHP notes an occurrence of Olive-sided Flycatcher approximately 2 miles SW of the Project Section. "This forest flycatcher historically used recently burned areas, but now that most fires are suppressed, it often takes advantage of areas that have been logged, as well as other clearings and edges, which are superficially similar to post-fire stands" (birdweb.org).

1.10.2.3 Archeology and Historical Sites

The DNRC has no record of cultural resources within the Project's area of potential effect. However, a professional inventory of cultural resources has not been conducted. If previously unknown, cultural or paleontological materials are identified during project related activities, all work would cease until a professional assessment of such resources can be made.

1.10.2.4 County Road Use and Road Maintenance:

The DNRC Proposed Haul Route (see map preceding Chap. 1) would include Morrison Lane (from Highway 200, south), and the existing road up Ashby Creek and the East Fork of Ashby Creek. The first 2 miles (approximately) of the Proposed Haul Route is maintained by Missoula County. From the end of Missoula County Maintenance up to the Forks of East and West Ashby Creek is a Non-maintained County Road. The remainder of the Proposed Haul Route, road up the East Fork of Ashby Creek is owned by the DNRC.

The DNRC would not maintain the portion of Morrison Lane that is the responsibility of Missoula County. Missoula County performed maintenance including shaping road surfaces and dust abatement on the aforementioned road segment in 2011and 2012. The County protects roads from damage, by placing weight limits (limiting heavy truck traffic) during periods (i.e. "spring break-up") when roads are susceptible to damage.

The remainder of the Proposed Haul Route (from the end of Missoula County Maintenance) up to the Forks of East and West Ashby Creek is a Non-maintained County Road. Whereas the DNRC has no obligation to repair or maintain this segment of road, the Proposed Kamas Point Timber Sale would maintain this road segment proportional to its use and in compliance with Best Management Practices (BMPs).

The DNRC, through implementation of the Ashby Creek Road Relocation Project, is in process of replacing a portion of the aforementioned County Road on DNRC's land in Section 3, T12N, R16W, and has replaced a ditch relief culvert in Section 34, T13N, R16W.

The DNRC Proposed Kamas Point Timber Sale would improve the road up East Ashby Creek and the remainder of the Proposed Haul Route: the existing roads in Sections 13, 14, 15 and 16. T12N, R16W.

Other related DNRC Project Activities: Ashby Creek Road Relocation Project; aforementioned in Chapter 1.8.

1.10.2.5 Public Safety: Increased Traffic and Truck Speed

The DNRC does not have the authority to enforce speed along Morrison Lane nor any other Public Roads (County). However any DNRC project-related activities would comply with and be subject to any applicable rules or laws. The Timber Sale Contract would stipulate signing of roads to alert road users of traffic associated with Timber Sale Activities. The

DNRC Forest Officer would communicate safety related concerns, such as warning Contractors to be cognizant of times when commuters and school children are on or along roads. Contract Operations would be monitored for safety by the Forest Officer. Whereas some local residents who use Morrison Lane are concerned about traffic related safety issues, they are likely accustomed to licensed commercial truck traffic that has occurred for many years past and as recently as 2010 (not including activities associated with the DNRC's Ashby Creek Road Relocation Project that began in 2012).

Should the Action Alternative be implemented, the Timber Sale Contract period would be three years. Transportation of forest products (hauling), road maintenance, re-construction of road segments and construction activities would be on-going within this three year period. It is estimated that approximately 820 loads of logs would be hauled within the three year period. The majority of hauling would likely occur during the last two years of the Contract period. Final road maintenance activities would occur after hauling is completed. Haul rates are expected to fluctuate. Whereas production rates of 5 loads per day could be expected, it is estimated that the rate could peak at approximately 10 loads per day at times. Although not expressly limited, hauling would likely take place on week days (20 days per month) and could last 4- 8 months.

2.0 Alternatives Including the Proposed Action

2.1 Introduction

Chapter 2: The purpose of Chapter 2 is to describe the alternatives and compare the possible effects of the proposed alternatives by summarizing the potential environmental consequences.

Alternatives were developed as a result of identification of relevant issues through the scoping process. Input from Interdisciplinary Team (IDT) specialists, including identification of relevant issues, shaped alternative development. The Action Alternative B conforms to the requirements of the State Forest Land Management Plan (SFLMP), Administrative Rules for Forest Management, the Trust Land Mandate and the HCP.

Chapter 2 describes and compares the alternatives by summarizing the attainment of the project objectives and the predicted environmental consequences.

This chapter has six sections:

- Process Used to Formulate the Alternatives
- Alternative Design Criteria
- Description of Proposed Alternatives
- Suggested Mitigation Measures of Alternative B: Harvest
- Description of Relevant Past, Present, and Reasonably Foreseeable Future DNRC Actions Not Part of the Proposed Action
- Summary Comparison of the Activities, the Predicted Achievement of the Project Objectives and the Predicted Environmental Effects of the Alternatives

2.2 Development of Alternatives

In May of 2011, a DNRC Interdisciplinary Team (IDT) began analyzing the Project Area and initiated internal review and public scoping to develop a management plan. Issues identified during the scoping process were defined and are summarized in Chapter I. Input from Interdisciplinary Team (IDT) specialists, including identification of relevant issues, shaped alternative development. The Action Alternative was developed in part to address relevant issues. Mitigation measures are listed in 2.5.

2.3 Alternative Design Criteria

The DNRC IDT identified the following design criteria:

- Comply with the Montana Environmental Policy Act (MEPA)
- Comply with the Montana Administrative Rules for Forest Management (ARM) and Streamside Management Zones (SMZ's).
- Comply with the requirements of the Endangered Species Act (ESA).
- Comply with DNRC's Habitat Conservation Plan (HCP).

- Comply with all other applicable Federal and State of Montana: Laws, Rules and Regulations.

The proposed Action Alternative adequately addressed relevant issues and met project objectives. Therefore no other alternatives were considered.

2.4 Description of Alternatives

2.4.1 Alternative A: No Action

Activities associated with the Timber Harvest Alternative would not occur on the Project Area at this time. No revenue would be generated for the Common School Trusts for the specific Lands included within the Project Area. DNRC permitted and approved activities would continue in the Project Area.

2.4.1.1 Continuing actions not part of the Proposed Action

- **Livestock grazing:** an existing grazing lease would continue within the Project Area.

- **Fire suppression:** human and natural caused fires would be actively suppressed.

- **Hunting and other recreational uses:** deer, elk, and upland game hunting would continue under the rules of the Montana Department of Fish, Wildlife, and Parks. Walk in and non-motorized vehicle recreational use would continue.

- **Control of weeds:** The DNRC employs an integrated approach to weed control including monitoring and administering weed control activities.

- **Public vehicle access:** Motorized access to the DNRC Kamas Point Section 16, T12N, R16W would remain restricted. Non-motorized access to DNRC lands could continue. Walk-in hunting is allowed, although there are gates in Section 13, 20 and 21, T12N, R16W that restricts motorized access to the east (approximately 3 miles), west and south (approximately ½ mile) boundaries of the Kamas Point Section (see map preceding Chap. 1). There are two existing roads on private property that could provide access to the NW corner of the Kamas Point Section, although public access may not be permitted across the private property. Similarly there are two roads that begin in the NW ¼ Section 9, T12N, R16W (private property) that could provide access to the NW 1/4 and NW, NE Section 16, T12N, R16W if it were allowed. There is a gate in the NW, NE Section 9, T12N, R16W (DNRC) that restricts access to the NE 1/4 Section 16, T12N, R16W. Roads that are currently restricted on

DNRC lands would remain so to prevent unauthorized motorized use. The DNRC does authorize motorized access for: emergencies: such as fire suppression and rescue operations; grazing lessees; authorized contractors, and DNRC employees charged with administrative duties and functions.

All of the aforementioned activities would also occur if Alternative B: Harvest were implemented.

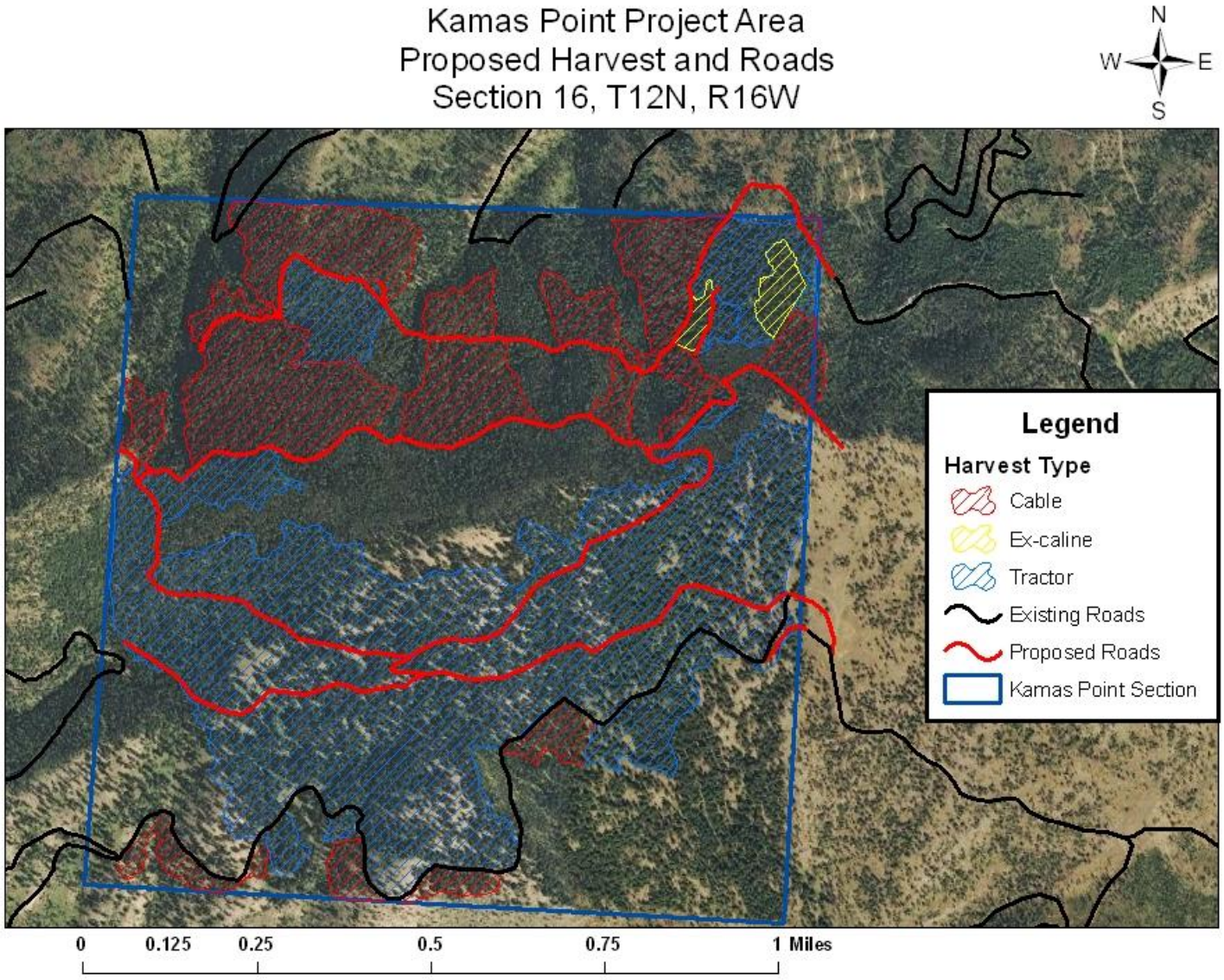
2.4.2 Alternative B: Harvest

- The proposed harvest would yield approximately 14,000-21,000 tons of saw-timber, from approximately 370 acres. Refer to Figure 2-1 Harvest map. Approximately 250 acres would be harvested with ground based equipment and 120 acres would be harvested with cable yarding.
- Approximately 5 miles of new road would be constructed in order to access harvest areas. With the exception of a 750' segment within Section 15, T12N, R16W; the proposed roads would be located within the Kamas Point Project Section 16, T12N, R16W.
- No harvesting would occur within Stream-side Management Zones (SMZ) or Riparian Management Zones (RMZ).
- New road construction would include installing a culvert within a Class 2 stream segment that is tributary to Wallace Creek.
- Maintenance, repairs and improvements would be completed on all roads used to transport forest products from proposed harvest areas.
- Approximately 1 snag and 1 snag recruit per acre would be retained within harvest areas (see 2.5.1 for more detail).
- Within harvest areas that are potentially Old Growth approximately 160 acres, a minimum of large diameter trees would be retained per Old Growth Type (as defined by Green et al), (see 2.5.5 for more detail).
- Within harvest areas that are classified as Lynx Habitat (approximately 230 acres) a minimum of 40% crown closure would be maintained (including sub-merchantable trees). It is estimated that the basal area (square foot cross sectional area of trees at d.b.h., per acre) retained within Lynx habitat would range from between approximately 50-80 square feet. Some shade intolerant species such as subalpine fir and spruce would be retained within Lynx Habitat.
- For the remainder of the proposed harvest area (approximately 140 acres that is not classified as Lynx Habitat) approximately 40-70 square feet of basal area would be retained in stands, (with exceptions noted above) consisting of well formed, well developed, insect and disease free trees, exhibiting better than poor vigor. The predominant treatment in the Douglas-fir and Douglas-fir/ Western Larch type stands would employ a shelterwood system. Shade intolerant species such as Western Larch and trace amounts of Ponderosa pine would be maintained where they occur. These stands would be managed with improvement-selection cutting, managing for retention of growing stock as well as maintaining and

recruiting larger diameter dominants as seed-trees for future entries. These stands would be left in a stocked condition favoring growth (approximately 60 sq. ft. where mitigations for wildlife are not indicated). Intermediate cuttings would be a combination of improvement, thinning, sanitation-salvage type treatments. There would be flexibility to create some small openings (1-5 acres). Some areas would be cut to favor regeneration, where stocking levels for trees retained would be 40sq.ft.of basal area. These openings would likely occur in areas where the trees are of poor and or declining vigor, and or areas of Douglas-fir beetle activity (sanitation-salvage treatments). These openings would encourage regeneration of a new age class of trees. Within areas receiving a salvage treatment, dead and insect infested trees would be harvested and crown cover would likely be reduced to the lower end of the range of 30-40% crown cover. Additional openings would be created adjacent to shade intolerant seed trees. Good quality advanced regeneration would be maintained and protected in areas where it occurs. Trees would be retained in groups or as individuals in a non-uniform spatial arrangement. Approximately 8 trees per acre (tpa) $\geq$ 21" diameter breast height (dbh) would be retained within harvested areas.

- A portion of the logging slash would be retained or returned within harvest areas (see Chap. 2.5.3 for details).
- Motorized public access would remain restricted at all times on restricted roads including those used for harvest activities.

Figure 2–1: Map of Alternative B: Harvest



2.5 Mitigation Measures of Alternative B: Harvest

The Harvest Alternative would incorporate some of the following mitigations by design and some would be incorporated through requirements within the Timber Sale Contract. Some issues and the associated mitigations are implemented programmatically. How the mitigations are incorporated is explained for each.

2.5.1 Harvest Unit General Design

- The Harvest Alternative would by design provide that approximately 1 snag and 1 snag recruit per acre would be retained within harvest areas. Trees selected for snags would be ≥ 21" diameter breast height (dbh), where available. If no snags ≥ 21" dbh are available then the next largest available size tree would be retained. Trees with extensive rot would be favored for retention as evidenced by broken boles, conks and cavities.

- Implementation of the Action Alternative would, through Timber Sale Contract stipulations, and administration, minimize soil impacts by limiting the total soil disturbance area in a unit. This would be accomplished by using existing trails, skid trail planning and design, and maintaining nutrient cycling by retaining woody debris and foliage.

- Implementation of the Action Alternative would limit ground skidding to slopes of 45% or less approximately; except on sensitive soils, where ground skidding would be confined to slopes 35% or less approximately. The objective is to minimize excessive disturbance such as compaction, displacement, rutting, and subsequent erosion.

- Implementation of the Action Alternative would, through Timber Sale Contract stipulations, limit ground skidding to periods when soils are in one of the following conditions: frozen, snow covered and or dry (soil moisture less than or equal to 20% of oven dry weight). The objective would be to minimize excessive disturbance such as compaction, displacement, rutting, and subsequent erosion.

- Implementation of the Action Alternative would, through Timber Sale Contract stipulations, require installation of various surface drainage features on skid trails, landings, and roads in order to conserve soils, protect roads and protect water quality.

- Implementation of the Action Alternative would protect localized sensitive soils, steep slopes, and moist areas by implementing equipment restriction zones.

- Implementation of the Action Alternative would comply with all Streamside Management Zone Laws/Rules and Forest Management Rules.

2.5.2 Road Design

- Implementation of the Action Alternative would employ forestry Best Management Practices (BMPs) as the minimum standard for all harvest and road activities associated with the proposed timber sale.

- The IDT designed a transportation plan that would facilitate near and long term transportation needs, and minimize new road construction. Practical, economical, and technical elements with respect to roads and road standards were considered to facilitate harvest. Construction and maintenance of necessary roads was considered within the context of potential affected resources. The Action Alternative, if implemented would by design improve existing road systems to meet long-term access needs and to fully comply with current BMPs.

- Implementation of the Action Alternative would, through Timber Sale Contract stipulations, require construction of drain dips, grade rolls and other drainage features where necessary and practical to insure adequate road surface drainage. Timber Sale Contract stipulations would require construction, reconstruction of roads and maintenance of roads, including installation and or construction of road surface drainage features prior to hauling. Maintenance of roads would continue as necessary and would be concurrent with harvest activities. At the completion of harvest activities a final blading of road surfaces would be required.

- Implementation of the Action Alternative would, through Timber Sale Contract stipulations, require application of grass seed to newly constructed or reconstructed road cut and fills.

- Implementation of the Action Alternative would, through Timber Sale Contract stipulations, require temporary or abandoned roads to be left in a stable condition that would provide adequate drainage and would not require future maintenance.

- Implementation of the Action Alternative would, through Timber Sale Contract stipulations, require construction of drainage features on approaches to draw and stream crossings to avoid concentrating runoff at crossing sites. The location of these drainage features would minimize the runoff contributing area and provide for effective sediment filtering.

- Implementation of the Action Alternative would, through Timber Sale Contract stipulations, require the cleaning of the inlets and outlets of culverts, including implementation of additional sediment mitigation measures as necessary.

2.5.3 Soils and Water- Site-Specific Design

- **Down Woody Material:** implementation of the Action Alternative would, through Timber Sale Contract stipulations, require that the majority of the logging slash be retained or returned within harvest areas. Approximately 5-10 tons per acre of coarse woody debris (>3" in diameter) and including finer fuels (< 3'' diameter, limbs and foliage) total accumulations of up to approximately 30 tons per acre, in some areas, would be retained or returned within harvested areas. Slash would be lopped and or trampled to within 18" or less of the ground. On slopes greater than 45%, this would be accomplished through retention of slash on site by log length skidding or whole tree harvest if tops and limbs were left on site. The slash would be well distributed, evenly throughout the unit and would be placed in trails to minimize disturbance to soils. Large amounts of slash would not be allowed to accumulate at the landings before it is returned in the unit. Slash would be cured for approximately one year, after which the DNRC would assess the need and benefit of burning any portion of the slash within harvested areas. Excessive amounts of slash, accumulations at landings and along roads, that were not scattered, would be piled and burned. Fuel breaks would be employed along property boundaries, roads and along ridge top locations.

- Implementation of the Action Alternative would, through Timber Sale Contract stipulations, require installation and maintenance of adequate erosion control within harvest areas, and skid trails as needed concurrent with operations. Erosion control would be completed prior to acceptance of skidding operations by the Forest Officer.

- Implementation of the Action Alternative would, through Timber Sale Contract stipulations, require rock armoring of both the inlet and outlet of all corrugated metal pipe (CMP) installations and energy dissipaters at outfall of all wet CMP installations.

- Implementation of the Action Alternative would, through Timber Sale Contract stipulations, require mitigations for activities in and around stream and draw crossings (i.e. installing new CMPs, cleaning inlets and outlets, constructing ditches, excavating material etc.) special care would be taken so as not to cause an excessive amount of disturbance to the stream channel, vegetation or area immediately adjacent to the crossing site. Excess or waste material would be disposed of at a location where it would not erode directly into the stream or draw bottom.

- Implementation of the Action Alternative would, through Timber Sale Contract stipulations, require road use and hauling be limited to dry (sufficient to prevent rutting), frozen and or snow covered conditions. The objective is to prevent sub-surface rutting of roads, prevent damage or

displacement of road surface materials and to facilitate function of surface drainage features. Operations would be suspended when these conditions were not met, prior to degradation of road surfaces.

- Implementation of the Action Alternative would comply with all applicable laws including the SMZ Law. Marking and maintenance of minimum SMZ widths consistent with law would be the minimum standard. Further protection to streams and riparian areas would be accomplished by following the ARM for Forest Management, Watershed Management-SMZ, and Riparian Management Zones (RMZ's) where needed.

- Implementation of the Action Alternative would protect all ephemeral draws, springs, and wet areas with marked equipment restriction zones (ERZ).

2.5.4 Integrated Weed Management

To reduce current noxious weed infestations and limit the spread of weeds the following integrated weed management mitigation measures for prevention and control would be implemented should the Action Alternative be selected:

- Implementation of the Action Alternative would, through Timber Sale Contract stipulations, require cleaning of all road construction and harvest equipment of plant parts, mud, and weed seed to prevent the introduction of additional noxious weeds. The equipment would be inspected by the Forest Officer prior to moving on site.

- Implementation of the Action Alternative would, through Timber Sale Contract stipulations, require prompt re-vegetation of all newly disturbed soils on road cut and fill slopes with site-adapted grasses (including native species) to reduce weed encroachment and stabilization of roads to prevent erosion.

- Ongoing integrated weed management on Missoula Unit may include establishing bio-control agent sites for knapweed within the Project Area on larger infestations, where appropriate.

- Implementation of the Action Alternative would, through Weed Spraying Contract stipulations, require herbicide applications along portions of roads within the Project Area and treatment of spot outbreaks of noxious weeds as determined by the ID team.

- Ongoing integrated weed management on Missoula Unit would include monitoring of disturbed sites within the Project Area for any new noxious weeds and develop plans as needed to address weed problems. If

new infestations of noxious weeds are noted, a weed management plan would be developed.

2.5.5 Harvest within potential Old Growth

For the Habitat Types and Cover Types (DF and WL/DF) within the Project Section, there are three Old Growth Types (as defined by Green et al), minimum requirements as follows:

1. 8 tpa ≥ 21" ≥ 170 years.
2. 10 tpa ≥ 21" ≥ 180 years.
3. 10 tpa ≥ 17" ≥ 180 years.

The proposed harvest would maintain sufficient numbers of large diameter trees within areas that are potentially Old Growth to satisfy the large diameter tree requirement (per relevant Old Growth Type) as specified above.

2.5.6 Public Safety- Transportation of Forest Products and Heavy Equipment

The Timber Sale Contract would contain stipulations for signing roads to warn motorists of potential hazards associated with encountering log trucks or other types of machinery traveling on roads or engaged in road reconstruction (improvement), construction and maintenance activities.

2.5.7 Air Quality- Smoke from Slash Burning

DNRC would submit plans for slash burning to the Smoke Management Unit of the Montana/Idaho Airshed Group. Burning would only be conducted as allowed by the Smoke Monitoring Unit, which would occur during periods of good to excellent smoke dispersion conditions.

2.5.8 Visual Quality Mitigation: Recommendations and Design Criteria:

Far views of the Project Section's northerly aspects would have the potential of being negatively impacted as a result of road construction and timber harvest. Roads on the northerly aspects (North Slope, see Figure 2-1) would be located when possible so they would not be visible from Highway 200 (far view from vicinity of Potomac looking south) and or would be mostly hidden from view. The upper road on the north-slope would be visible along segments; however the grade of the road would be rolled to help obscure it to the greatest extent practical. Trees within un-harvested areas above and below the upper North-slope road would partially screen the road. The lower road on the North Slope would be mostly hidden and less noticeable when viewed from afar (vicinity of Potomac), due to its lower elevation, would form an acute angle of observation and an oblique view. Additionally roads or segments of roads would be located on benches and flatter ground where possible. Trees would be retained along roads which would further help to obscure them. Timber stand variability would be preserved through retention of trees

from different age and or size classes of healthy dominant or co-dominant trees. Trees would be retained in groups or as individuals in a non-uniform spatial arrangement. Harvest boundaries would conform to natural stand boundaries (timber types, including those resulting from past fire effects) as most practical. As a result naturally created patterns would be retained. Where harvest areas coincide with "Lynx Habitat" sufficient tree canopy would be left so as to provide a minimum of 40% crown closure (percent area of tree crowns compared to a given area). Crown closure would be provided by retaining dominant seral tree species; some pole size trees and saplings would provide cover as well. Within portions of harvest areas advanced regeneration of shade tolerant species (sub-alpine fir and spruce saplings) would be retained along with intolerant species. The reduction of tree crown cover within harvest areas would relieve the hard edge effect along the Project Section boundaries. Group selection and shelterwood harvests, especially along edges would further relieve the defined edge effect that is evident as a result of past harvest along the east, west and north boundaries of the Kamas Point Project Section.

2.5.9 Wildlife

2.5.9.1 Threatened and Endangered Species

Implementation of the Action Alternative would, through Timber Sale Contract stipulations require, that if active den sites or nest sites of threatened, endangered, and/or sensitive species were located within the Project Area, activities would cease until such time as a DNRC Biologist could review the site and develop species appropriate protective measures. Implementation of the Action Alternative would, through Timber Sale Contract stipulations, require the following:

1. In the event any threatened or endangered species were encountered during the project implementation periods a cessation order would be issued by the Forest Officer to the Purchaser.
2. All project-related activities that would potentially affect that species would cease. The DNRC Biologist would be informed immediately and be instrumental in designing additional habitat protection measures where appropriate.
3. Additional mitigations would be consistent with the administrative rules for managing Threatened and Endangered Species (ARM 36.11.428 through 36.11.435) and the Endangered Species Act. The implementation of these mitigations would be at the sole discretion of the DNRC.

2.5.9.1.1 Grizzly Bears

Implementation of the Action Alternative would, through Timber Sale Contract stipulations, require implementation of sanitation restrictions during the non-denning period (April 15 - November 15) for operations related to the proposed action if grizzly bear activity is documented in the analysis area.

1. All operations associated with implementation of the Action Alternative would comply with all applicable State laws, rules and regulations concerning sanitation.
2. Refuse from foodstuffs including its packaging would be removed daily or secured in an approved bear resistant container.
3. Should camps be allowed within the Gross Sale area, foodstuffs would be contained in an approved bear resistant container.
4. Implementation of the Action Alternative would, through Timber Sale Contract stipulations, restrict contractors and their employees from carrying firearms in the project area or restricted roads used to access the project area.

2.5.9.1.2 Canada Lynx

Implementation of the Action Alternative would by design provide that in those portions of the Project Area where the proposed harvest overlaps suitable lynx habitat (i.e. Summer Foraging, Winter Foraging or Other Suitable Habitat):

1. The post-harvest conditions would meet $\geq$40% crown cover in sapling, pole, mature and old stands to retain Suitable Lynx Habitat characteristics;
2. Post-harvest up to 10% of the stand area would be retained in subalpine fir, Grand fir and Engelmann spruce regeneration, where present in the affected Winter Foraging Lynx Habitat stands.
3. Coarse woody debris retention would emphasize retention of downed logs of 15-inch diameter or larger.
4. Implementation of the Action Alternative would, through Timber Sale Contract stipulations require skid trail planning and special operation requirements i.e. protect sub-merchantable trees within the designated stands (classified as Lynx Habitat).

2.5.9.2 Sensitive and Other Wildlife Species

2.5.9.2.1 Pileated Woodpeckers and Fishers

Implementation of the Action Alternative would by design provide that in those portions of the Project Area proposed for harvest, snags, snag recruits and coarse woody debris would be recruited in accordance with ARMs 36.11.411 and 36.11.440 (1) (b) (iii), respectively. Additionally, for fishers in accordance with ARM 36.11.440 (1)(b)(i) and (i)(A), along class 2 streams on the affected parcel, the proposed action would maintain 75% of the area within 50 ft of the stream in $\geq$40% crown closure.

2.5.9.2.2 Flammulated Owls

Implementation of the Action Alternative would, by design, provide that in those portions of the Project Area proposed for harvest, snags and snag recruits would be recruited in accordance with ARMs 36.11.411 and 36.11.440 (1) (b) (iii).

2.5.9.2.3 Big Game: Elk

Implementation of the Action Alternative would, through Timber Sale Contract stipulations require, effective closure devices (e.g., locked gates, tank traps, other obstructions: rocks, woody debris) during project activities and at project's completion. Currently there is a sign at the gate in Section 13 (see Proposed Haul Route map preceding Chap. 1) that informs the public, that road use beyond the gate is restricted (is closed) to all motorized vehicles. Signs will be used concurrent with harvest activities noting (that although the gate in Section 13 may be open while hauling or road construction activities are occurring), that no unauthorized access (i.e. public access, "Authorized Use Only") is allowed. Existing gates (including the gate in section 13) would be closed and locked during inactive periods (nights, weekends, etc.). Roads and skid trails would be left in a condition post-harvest to reduce the potential for unauthorized motor vehicle use. Following harvest all new and existing roads used to transport forest products and within the Kamas Point Section would be closed or remain closed to motorized public traffic.

2.5.10 Archeology and Historic Sites

If previously unknown, cultural or paleontological materials are identified during project related activities, all work will cease until a professional assessment of such resources can be made.

2.6 Environmental Effects of Alternatives

2.6.1 Summary comparison of Project Activities

Table 2-1: Summary of Project Activities of Alternatives A and B.
The following table provides a comparison of the harvest activities that would occur if either Alternative A or B were implemented.

Activity	Alt. A	Alt. B
HARVEST (ACRES)	0	370
Tractor yarding (approximate acres)	0	250
Cable yarding (approximate acres)	0	120
Road construction (approximate miles)	0	5

All roads in the Project Area would remain closed to motorized public use after the project is completed.

2.6.2 Summary comparison of achievement of Project Objectives

Table 2-2: Summary Comparison of achievement of Project Objectives

Objective	Indicators	Alt. A	Alt. B
Harvest approximately 14,000-21,000 tons of timber to generate revenue for the School (CS) grants.	Stumpage receipts in dollars	0	Generate approximately $100,000-150,000 ($7.14/ ton) for the Common School Grants
Promote forest health and vigor, reduce incidence of insects and disease.	Acres treated	0	Approximately 370 acres
Regenerate and promote advanced regeneration in portions of stands.	Acres treated	0	Equivalent to approximately 37 acres of openings and areas with ≤ 40 sq. ft. of basal area scattered throughout the harvest area
Maintain critical elements of biologically diverse forests with respect to Threatened and Endangered Species.	Acres of Lynx Habitat protected	Approximately 431 acres	40% crown cover would be maintained within Harvest Areas that are Lynx Habitat, approximately 230 acres.

2.6.3 Summary comparison of Environmental Effects

Table 2-3: Summary of Environmental Effects

ISSUE	Alternative A: No Harvest (No Action)	Alternative B: Harvest
WATER QUALITY, SOIL, FISHERIES, WEEDS:		
WATER QUALITY	Direct, indirect and cumulative effects evaluated were those associated with past management activities within the Project Area. Direct, indirect, and cumulative effects within the Project Section were observed to be minimal.	Proposed harvest activities including road construction have low to moderate risk of minor and temporary increased sediment during culvert installations. BMPs and erosion control mitigation measures would be implemented to prevent sediment delivery from roads to streams. Long term there would be an improvement in water quality and reduction in sediment, although low levels of sediment delivery may persist on the existing road adjacent to the East Fork of Ashby Creek. No timber harvest would occur in SMZ's. There is low to moderate risk of direct, indirect, or cumulative effects.
WATER YIELD	There would be no potential for increases in water yield as a result of DNRC activities.	Low risk of adverse impacts to stream channel stability. Low risk of detrimental cumulative impacts due to increased water yield. There is low risk of direct, indirect, or cumulative effects from implementation of this alternative.
CUMULATIVE WATERSHED EFFECTS	Measurable cumulative effects from past management activities of poorly located roads with inadequate drainage on other ownerships would continue to occur (refer to existing conditions discussion). Cumulative effects are expected to decline as hydrologic recovery continues to occur.	The proposed harvest and road construction would present a low to moderate risk of cumulative impacts of increased sediment delivery by disturbing soil. The risk of cumulative effects from sediment delivery would be reduced by using erosion control measures and stream crossing site improvements. There is a low risk of adverse impacts to downstream water quality and beneficial uses occurring as a result of the proposed project.
SOIL RESOURCES	Direct and indirect effects on soil resources would continue to occur, as road surface drainage within the Project Area would not be improved.	Tractor skidding could cause direct effect to soils that could result in increased erosion. Mitigation measures would maintain soil resources and minimize disturbance. Retention of slash and coarse woody debris would have a long-term beneficial effect to nutrient cycling, maintain long-term soil productivity and reduce on-site erosion.

COLD WATER FISHERIES	There would be no change of direct, indirect or cumulative impacts to fisheries.	There is a low risk of direct, indirect, or cumulative effects to cold-water fisheries associated with the Action Alternative. Direct effects are potential sediment delivery from road construction, maintenance, and soil disturbance. Mitigations to control sediment and application of erosion control measures would minimize disturbance. Because no harvest would occur in the SMZ's or RMZ's there would be no effect on large woody debris recruitment or stream shading. We expect there will be a long term benefit to Ashby Creek due to a reduction in current sediments from road drainage.
NOXIOUS WEEDS	There would be a gradual increase in noxious weed infestations over time. Integrated weed management efforts would continue on these lands, but with less funding than would be provided for as a result of the implementation of Harvest Alternative B.	Similar or slight increase in noxious weed density and occurrence, due to soil disturbance and decreased tree canopy. Integrated weed management efforts would continue throughout the Project Area. Control efforts would promote re-vegetation and emphasize treatment of any new noxious weeds. More Forest Improvement dollars would be available for weed control.
FOREST VEGETATION AND OLD GROWTH	Slow growth rates and mortality would continue within timber stands including those that are classed as Old (≥150 years, 81% of Project Section). Slash loads (down coarse-woody debris) would increase. Shade tolerant species coverage would increase. Increased risk of high severity fire effects.	Overall stand vigor and growth rates would improve within treated areas as a result of reduced stocking and retention of trees with best available crowns, health, vigor and form. Improved stand vigor and removal of insect infested Douglas-fir trees would help prevent further mortality. Regeneration would add to stand structure by creating a new age class. Retention of Western larch and reduction of shade tolerant species would trend stands toward the Desired Future Condition. Decreased stand densities and removal of "ladder fuels" would decrease the risk of stand replacement fire. Short term (1-3 years) there would be an increased risk for more rapid surface fire spread due to increased fine fuel load. The proposed harvest would remove the least vigorous portion of Old trees. Thus there is a moderate risk that the proposed harvest would decrease the quantity and quality of Old Growth; and increase the time required for development of Old Growth, by reducing the amount of Old large diameter trees, snags and coarse-woody debris.

AIR QUALITY	Log hauling from DNRC lands would not occur. No slash burning would occur.	There would be an increase in road dust, if logs were hauled from DNRC lands under dry road conditions. Minimal direct and cumulative effect. A permit to burn slash would be obtained from the Smoke Management Unit. Slash burning would occur in the fall (likely beginning sometime in October –November 30) when burning is permitted. The estimated time it would take to ignite slash piled is approximately two weeks (10 man days). Minimal direct (short term) and cumulative effects.
ECONOMIC BENEFITS AND EXPECTED REVENUES	No economic contribution or benefits to the School Trusts would occur within the foreseeable future. This would have a direct effect upon the School Trust and DNRC's obligation to provide the School Trusts with income from Trust Lands.	The investment into the road infrastructure under this alternative would be approximately $7/ton (negative with respect to stumpage value). However, this investment would decrease future management costs. The forest improvement collections (FI: $3.24/ ton) would be approximately $45,360-$68,040. This money would be deposited in the forest improvement fund to be used for thinning, prescribed burning, planting, weed management, and management activities on Trust Lands. The stumpage would provide the School Trusts revenues projected between $100,000 and $150,000, or $7.14/ ton. The proposed project would provide work for road-building contractors, logging contractors, their subcontractors, and their employees. The logs would likely be processed by local mills sustaining employment opportunities.
HISTORICAL AND ARCHAEOLOGICAL SITES	There is a low risk for direct, indirect or cumulative effects.	The DNRC has no record of cultural resources within the Project's area of potential effect. However, a professional inventory of cultural resources has not been conducted. If previously unknown, cultural or paleontological materials are identified during project related activities, all work would cease until a professional assessment of such resources can be made. There is a low risk for direct, indirect or cumulative effects.

WILDLIFE:	Alternative A: No Harvest (No Action)	Alternative B: Harvest
MATURE FORESTED HABITATS AND LANDSCAPE CONNECTIVITY	The risk of direct, indirect, and cumulative effects would be negated because: 1) no changes to existing stands would occur; 2) no appreciable changes to forest age, the distribution of dense forested cover, or landscape connectivity would be anticipated; and 3) no changes to wildlife use would be expected.	A minor-moderate risk of adverse direct, indirect, and cumulative effects would be expected since: 1) harvesting would alter additional mature stands, further reducing those attributes in a landscape where they have been reduced considerably in the past; 2) landscape connectivity would be altered, but past management has already compromised connectivity in the area; and 3) some changes to wildlife use would be expected.
ENDANGERED SPECIES:	**Alternative A: No Harvest (No Action)**	**Alternative B: Harvest**
GRIZZLY BEAR	No further adverse direct, indirect, and cumulative effects would be anticipated since: 1) no changes in human disturbance levels would be expected; 2) no changes to open road density would occur; 3) no further modifications to hiding cover would occur; and 4) no changes to security habitats would be expected.	A minor risk of adverse direct, indirect, and cumulative effects would be anticipated since: 1) minor disturbance and displacement would be anticipated; 2) hiding cover would be reduced in a portion of the project area, but would remain in portions of the project area and cumulative effects analysis area; 3) no changes to security habitats would be expected; and 4) no changes to long-term open road density would be anticipated.
LYNX	A negligible risk of adverse direct, indirect, and cumulative effects would be expected since: 1) winter foraging habitats would persist; 2) summer foraging habitats would gradually disappear through time without disturbance; 3) no changes in the amount of the area that is in the temporary non-suitable habitat class would occur; and 4) landscape connectivity would not be altered.	Collectively, a minor risk of adverse direct, indirect, and cumulative effects would be expected since: 1) some winter foraging habitats could be reduced; 2) negligible changes to summer foraging habitats would occur, and some future summer foraging habitats could be created; 3) some lynx habitats would be in the temporary non-suitable lynx habitat category; and 4) negligible alterations in landscape connectivity would not prevent lynx movements.

SENSITIVE SPECIES:	Alternative A: No Harvest (No Action)	Alternative B: Harvest
FISHER	No further direct, indirect, and cumulative effects would be anticipated since: 1) no changes to existing habitats on DNRC-managed land would occur; 2) any landscape connectivity afforded by the stands on DNRC-managed lands would not change appreciably; 3) no changes to snags, snag recruits, or coarse woody debris levels would be expected; and 4) no changes to human access or the potential for trapping mortality would be anticipated.	A minor risk of adverse direct, indirect, and cumulative effects would be anticipated since: 1) harvesting would avoid riparian areas; 2) harvesting would reduce or remove upland fisher habitats; 3) minor alterations to landscape connectivity would occur, but those areas associated with riparian areas would remain unaffected; 4) harvesting would reduce snags and snag-recruitment trees while increasing coarse woody debris levels; however, some of these resources would be retained; and 5) no appreciable changes in motorized human-access levels would be anticipated.
FLAMMULATED OWL	A negligible risk of adverse direct, indirect, and cumulative effects would be anticipated since: 1) no harvesting would occur, 2) no changes to potential nesting habitats would be anticipated, and 3) long-term, succession-related declines in foraging habitats coupled with advancing succession leading to denser, less suitable foraging conditions.	A minor risk of positive direct, indirect, and cumulative effects would be expected since: 1) harvesting would open denser stands up; 2) elements of forest structure used for foraging and nesting by flammulated owl would be retained; and 3) prescriptions would lead to more open stands with scattered mature ponderosa pine.
PILEATED WOODPECKER	A negligible risk of adverse direct, indirect, and cumulative effects would be expected since: 1) no further harvesting would occur; 2) no changes in the amount of continuously forested habitats would be anticipated; 3) no appreciable changes to existing pileated woodpecker habitats would be anticipated; and 4) long-term, succession-related declines in the abundance of shade-intolerant tree species, which are valuable to pileated woodpeckers, would be anticipated.	A minor risk of adverse direct, indirect, and cumulative effects would be anticipated since: 1) harvesting would reduce the amount of continuous-forested habitats available; 2) some potential nesting habitats and foraging habitats would be removed while others that would be retained would be of lower quality; 3) snags and snag recruits would be removed; and 4) proposed treatments would promote seral species.

BIG GAME:	Alternative A: No Harvest (No Action)	Alternative B: Harvest
WINTER RANGE	A minor risk of positive direct, indirect, and cumulative effects would be anticipated since: 1) subtle changes in thermal cover due to advances in succession that would increase canopy densities would be anticipated over time; 2) the amount of mature forested habitats on the winter range would not change; and 3) the levels of human disturbance would remain similar.	A minor risk of adverse direct, indirect, and cumulative effects would be anticipated since: 1) there would be a low potential for disturbance or displacement of wintering big game; 2) a small percentage of the winter range would be altered, 3) availability of cover on surrounding ownerships that provides some opportunity for deer should they be displaced.
ELK SECURITY HABITAT	A minor risk of positive direct, indirect, and cumulative effects would be anticipated since: 1) no changes in open roads, motorized access, or human access would be anticipated; 2) no reductions in elk security habitat would occur; and 3) modest levels of security habitat and hiding cover would persist within the cumulative-effects analysis area, and 4) no appreciable changes to big game survival would be anticipated.	A minor risk of adverse direct, indirect, and cumulative effects would be anticipated since: 1) no changes in open roads or motorized access for the general public would be expected; 2) quality of hiding cover in a small portion of the cumulative effects analysis area would be reduced, which would reduce the quality of the elk security habitats; 3) security habitat and hiding cover would persist in the cumulative-effects analysis area; and 4) negligible changes in big game survival would be anticipated

3.0 Affected Environment (Existing conditions)

Introduction:
Chapter 3: Affected Environment succinctly describes existing conditions for the relevant resources that would be affected by the alternatives if they were implemented. This chapter also includes effects of past and ongoing management activities within the analysis area that might affect project implementation and operation.
This description of the existing environment in Chapter 3 establishes a baseline of comparison from which the activities of Alternative A: No Action (in Chapter 2), and the predicted effects of Alternative A: No Action (in Chapter 4), can be contrasted against the potential effects of Alternative B: Harvest (in Chapter 4).

3.1 Water

3.1.1 Water Quality and Quantity-Analysis Methods & Areas

Existing and potential impacts to water quality were evaluated in the field by reviewing existing roads, existing stream crossings, and proposed road locations, and evaluating the risk of potential sediment delivery from those locations. Potential sediment delivery from proposed harvest areas was evaluated using a risk assessment of potential upland soil disturbance.

Existing and potential water yield increases were estimated using the Equivalent Clearcut Area (ECA) method as outlined in Forest Hydrology, Part II (Haupt et al, 1976). ECA is a function of total area roaded, harvested, or burned; percent of crown removed during harvesting or wildfire; and amount of vegetative recovery that has occurred within the harvested or burned areas. When live trees are removed from a given area, water yield increases proportionally to the magnitude of change within a watershed. Precipitation (water) that would have otherwise evaporated (intercepted by tree crowns, not reaching the soil) and transpired (used by trees), can saturate soils increasing the potential for runoff. The ECA method also estimates recovery within the affected watershed, and assumes that new trees (regeneration) would be established post-harvest, moving the Project Section toward the pre-harvest watershed condition.

In order to evaluate the potential effects of estimated water-yield increases, a threshold of concern for each watershed was established per *ARM 36.11.423*. Thresholds were established based on evaluating the acceptable risk level, resources value, stream channel stability and watershed sensitivity. Increased annual water yields above the threshold of concern may result in an increased risk of in-channel (stream) erosion and degradation of fisheries habitat.

Analysis Area
The proposed harvest area (Project Section 16, T12N, R16W) is located on the top of the Garnet Mountain Range (Mineral Ridge). The Project Section forms the divide between three different watersheds. The northern portion of the Project Section is located within the watershed area of Ashby Creek. The southern portion of the Project Section is located primarily within the West Fork of Cramer

Creek, with a lesser amount located within the watershed area of an unnamed tributary to Wallace Creek. The analysis area delineated for Ashby Creek includes the upper portion of the watershed, starting approximately 1.75 miles downstream of the confluence of the West Fork and the East Fork of Ashby Creek and continuing upstream to its headwaters. This portion of the Ashby Creek watershed includes the predominately forested headwaters of the drainage and does not include any irrigation diversions or withdrawals. The lower Ashby Creek watershed was not included in this analysis area because the land use is primarily agriculture and residential with substantial stream dewatering due to irrigation diversions and withdrawals. The lower portion of the Ashby Creek watershed is predominantly private ownership. The watershed analysis areas for West Fork of Cramer and the Unnamed Tributary to Wallace Creek include the entire drainage areas for these watersheds. These three watersheds have been identified as the analysis areas for describing the potential direct, indirect and cumulative effects to water resources.

3.1.2 Water Quality Standards: Regulations and Beneficial Uses

This portion of the Clark Fork and Blackfoot River Basins, including Cramer Creek, Wallace Creek and Ashby Creek, are classified as B-1 by the Department of Environmental Quality (DEQ), as stated in ARM 17.30.609. The water-quality standards for protecting beneficial uses in B-1 classified watersheds are located in ARM 17.30.623. Water in B-1 classified waterways is suitable for drinking, culinary and food processing purposes after conventional treatment, bathing, swimming and recreation, growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers, and agricultural and industrial water supply. State water-quality regulations limit any increase in sediment above the naturally occurring concentration in water classified B-1. Naturally occurring means condition or materials present from runoff or percolation over which man has no control or from developed land where all reasonable land, soil, and water conservation practices have been applied (ARM 17.30.602 [17]). Reasonable land, soil, and water conservation practices include "methods, measures or practices that protect present and reasonably anticipated beneficial uses" (ARM 17.30.602 [21]). The State of Montana has adopted Best Management Practices (BMPs) through its non-point source management plan as the principle means of meeting the Water Quality Standards.

Water Quality Limited Water Bodies:

The East Fork of Ashby Creek, West Fork of Ashby Creek, Cramer Creek, and Wallace Creek are all listed water quality limited water bodies on the Montana 2010 303(d) list and the Draft 2012 303(d) list. The 303(d) list is compiled by DEQ as required by Section 303(d) of the Federal Clean Water Act and the Environmental Protection Agency (EPA) Water Quality Planning and Management Regulations (40 CFR, Part 130). Under these laws, DEQ is required to identify water bodies that do not fully meet water-quality standards, or where beneficial uses are threatened or impaired.

3.1.3 Existing Conditions- Water Quality and Water Quantity

Ashby Creek is a 4th order, class I, perennial tributary to Union Creek in the Blackfoot River Basin. The primarily forested upper watershed that was delineated for this analysis is approximately 7,614 acres in size. The average annual precipitation of the watershed analysis area is approximately 21 inches. Channel types within the watershed are predominately B3 and B4 (Rosgen 1996). Beneficial uses in the watershed include irrigation, livestock watering and cold-water fisheries.

Extensive timber harvest has occurred within the Ashby Creek watershed. The majority of the forested land within the watershed was until recently (2009) owned and managed by Plum Creek Timber Company (PCTC). In 2009 The Nature Conservancy (TNC) purchased Plum Creek Lands within the Ashby Creek watershed. TNC harvested timber from some of these lands within Ashby Creek watershed as recently as 2010. In November of 2010 the DNRC purchased lands within the Ashby Creek watershed from TNC (lands previously owned by PCTC).

Approximately 29% of the watershed area in Upper Ashby Creek is currently in equivalent clearcut area (ECA). Estimates of existing water yield increase are at 12% when compared to fully stocked forested conditions. Water yield thresholds were established for the Ashby Creek watershed as outlined under DNRC Forest Management *ARM 36.11.423*. These thresholds are based on evaluating the acceptable risk level, resources value, stream channel stability and watershed sensitivity. Increased annual water yields above the threshold of concern may result in an increased risk of in-channel erosion and degradation of fisheries habitat. The threshold established for increases in average annual water yield within the Ashby Creek drainage is 13%.

Despite the intensive levels of timber harvest that has occurred within the Ashby Creek watershed, the estimate of increased average annual water yield are below threshold levels. In addition, most of the forest stands within the watershed are fully stocked with saplings and or pole size timber. Water yield is expected to decrease as forests mature.

Channel surveys completed by DNRC in 2011 and 2012 indicate no channel instability due to increased water yields or increased magnitude or duration of peak flows. Channel stability throughout most of the watershed was rated as being relatively good and in an overall stable condition. Channel segments with lower stability are largely attributed to localized factors such as poor road location, channelization, mine waste and concentrated livestock use. Stream flows within Ashby Creek are largely spring fed and do not appear to fluctuate greatly between base flow and peak flows.

Past grazing impacts within the Ashby Creek drainage have largely been mitigated by several riparian grazing exclosures that were installed under the Plum Creek Native Fish Habitat Conservation Plan. Remaining impacts due to cattle grazing are isolated and not extensive.

The portion of the Project Section within the Ashby Creek watershed is drained by numerous ephemeral swales and draws that do not contain discernible stream channels. One draw feature in the northwest ¼ contains a short isolated segment of intermittent stream channel. This segment would be buffered with a no-harvest SMZ. However, this intermittent reach of stream is discontinuous and there are no stream channels draining the Project Section that have contiguous connectivity or surface delivery to Ashby Creek.

The Proposed Haul Route is primarily located within the Ashby Creek watershed which includes the East Fork of Ashby Creek. The portion of the Proposed Haul Route that is located immediately adjacent to streams does not meet BMPs and is contributing direct sediment delivery. Approximately 0.6 miles of existing road within DNRC Section 3, T12N, R16W is located immediately adjacent to the mainstem of Ashby Creek and contains several undersized stream crossing culverts with poor alignments. Stream flow at these sites is periodically diverted onto the road surface during high flow and stream ice jam events and carried considerable distances down the road grade before flowing back into the stream channel. These periodic flow events are a chronic source of road erosion and sediment delivery to Ashby Creek.

Approximately 2.45 miles of the Proposed Haul Route is located immediately adjacent to the East Fork of Ashby Creek on DNRC and privately owned land. The following general BMP deficiencies were found at numerous locations on the 3.05 miles of access road that are located immediately adjacent to Ashby and the East Fork of Ashby Creek:

1) Inadequate road surface drainage.
2) Road drainage routed through inadequate filtration zone before entering stream.
3) Road drainage routed directly to stream or stream crossing site.
4) Plugged or non-functional ditch relief drainage culverts.
5) Lack of functional ditch or lack of ditch maintenance.
6) Non-functional drain-dips that are either substandard or need maintenance.

These BMP departures have resulted in direct delivery of sediment at numerous sites along the existing road (the portion of the Proposed Haul Route) located immediately adjacent to Ashby and the East Fork of Ashby Creek. A complete inventory of the existing access road BMP problems sites, including sites with direct sediment delivery to streams, is available in the Watershed Analysis Project File.

Ashby Creek Road Relocation Project (Independent of Action Alternative): There is currently (implemented 2012) an ongoing restoration project that has been designed to address the 0.6 mile segment of road located immediately adjacent to Ashby Creek. The project is a collaborative undertaking between

DNRC, Blackfoot Challenge, Big Blackfoot Chapter of Trout Unlimited, The Nature Conservancy, and Missoula County. The project involves relocation (construction) of approximately 5,000 feet of road, to replace the portion of road located immediately adjacent to Ashby Creek. The road segment being constructed is located upslope (west of the creek) and outside of the floodplain of Ashby Creek. This project would also eliminate three existing culvert stream crossings, obliterate the original road prism, includes several segments of stream channel restoration, and construction of a single bridge stream crossing at the Fork of East and West Ashby Creek. When road construction and stream restoration are completed, a riparian grazing exclosure approximately 38 acres in size with a 10,000-foot perimeter and 2 water gaps would be constructed to allow the stream restoration to stabilize and the riparian vegetation to recover. The Ashby Creek Relocation Project will not address problems sites identified on the 2.45 mile segment of the Proposed Haul Route located immediately adjacent to East Fork of Ashby Creek.

The East Fork of Ashby Creek is included on the 303(d) list because the aquatic life support beneficial use is only partially supporting. Probable causes are listed as alteration of streamside vegetative cover, Nitrate/Nitrite, Phosphorus and sedimentation/siltation. The probable sources are listed as forest roads (road construction and use), silvicultural activities and riparian grazing. A Total Maximum Daily load (TMDL) has been completed for sediment in the East Fork. The East Fork of Ashby Creek also contains several historic mining sites. Even though mining was not included as a probable source of sediment pollution in the Montana 303(d) list, water quality has and continues to be impacted by the effects of historic mining within the drainage. For example, on private land in Section 10, T12N R16W, the East Fork of Ashby Creek has been channelized between the existing access road and un-vegetated mine waste and tailings materials. These fine and coarse grained sediments are being actively eroded into the stream due to the channel flow itself.
Approximately 2.45 miles of the Proposed Haul Route is located immediately adjacent to the East Fork of Ashby Creek on DNRC and privately owned land. This road segment is currently contributing direct sediment delivery to the East Fork of Ashby Creek.

The West Fork Ashby Creek is included on the 303(d) list because the aquatic life support beneficial use is only partial supporting. Probable causes are listed as alteration of stream-side vegetative cover, phosphorus, and sedimentation/siltation. Probable sources include forest roads (construction and use) silvicultural activities, and unknown sources. A TMDL has also been completed for sediment in the West Fork of Ashby Creek.

Cramer Creek is on the 303(d) list because both aquatic life support and primary contact recreation beneficial uses are only partially supporting. Probable causes of impairment include arsenic, barium, cobalt, copper, lead, mercury, physical substrate habitat alterations and sedimentation. Probable sources include impacts

from abandoned mines, and highway/road/bridge runoff (non-construction related). No TMDL have been completed for Cramer Creek. However, a project plan outlining the steps for the development of a metal's TMDL has been put together for the Bonita-Superior Project Area by the DEQ.

The West Fork of Cramer Creek is a perennial 3rd order tributary to Cramer Creek. That portion of the Project Section located within the West Fork Cramer Creek watershed is drained by several ephemeral swales and draws. Several of the draws contain isolated springs with short segments of intermittent channel. However all of these channel segments are discontinuous with no direct channel connectivity with the West Fork of Cramer Creek. One of these, an isolated spring segment (approximately 200' long and no perceptible channel below) is located within the proposed harvest area (NESE). This segment would be buffered with a no-harvest SMZ.

Approximately 2 miles of existing low standard road that would be used as part of the Proposed Haul Route is located within the West Fork of Cramer Creek drainage (and within the Project Section). The road is located below the top of Mineral Ridge (Garnet Range Divide) and does not contain any stream crossings. The road does not fully meet BMPs, however, there are low levels of road surface erosion with no direct delivery to streams or ephemeral draws. This road is low risk for sediment delivery or impacts to down slope water quality and beneficial uses.

Approximately 26% of the watershed area in the West Fork of Cramer Creek is in equivalent clearcut area (ECA). Estimates of existing water yield increase are at 11% over fully forested conditions. The increased water yield threshold established for Cramer Creek is 15%. Despite the intensive levels of timber harvest occurring in the watershed, the estimated increases in average annual water yield are below threshold levels. In addition, most of the forest stands remain fully stocked with advanced regeneration and pole size timber. Channel surveys completed by DNRC in 2011 do not indicate that there is any evidence of existing channel instability due to increased water yields or increased magnitude or duration of peak flows. Channel stability throughout most of the watershed was rated as being in relatively good and stable condition. Stream flows in the West Fork of Cramer Creek are largely spring fed and do not appear to fluctuate greatly between base flow and peak flows.

Wallace Creek was included on the 303(d) list because Aquatic life support beneficial use is only partially supporting. The probable causes of impairment are copper and zinc. The probable sources are impact from abandoned mines. Wallace Creek has been included in the Bonita-Superior Project Plan for the development of a heavy metal TMDL. The TMDL is scheduled for development during the year 2012.

Unnamed Tributary to Wallace Creek
A small portion of the Project Section is located within the drainage area of an Unnamed Tributary to Wallace Creek. Within this portion of the Project Section is a short reach of discontinuous class 2 stream. Downstream beneficial uses in the watershed include domestic, irrigation, livestock watering and cold-water fisheries.

There is an existing road segment approximately 500 feet long that is within the NW1/4 of the SW1/4 of the Project Section (crossing the west boundary). There is an existing culvert crossing of an intermittent reach of the unnamed tributary to Wallace Creek on this road segment. Upslope of the existing crossing there is a short reach of spring feed perennial stream channel. A new road culvert crossing is proposed on this discontinuous perennial reach. Additionally there are old skid trails from past harvest activities that are vegetated. No erosion or sediment delivery to down slope water resources were observed in this portion of the Project Section.
Approximately30% of the watershed area in the Unnamed Tributary to Wallace Creek is in equivalent clearcut area (ECA). Estimates of existing water yield increase are at 14% over fully forested conditions. The increased water yield threshold established for this Unnamed Tributary to Wallace Creek is 15%. Despite the intensive levels of timber harvest occurring in the watershed, the estimated increases in average annual water yield are below threshold levels. In addition, most of the forest stands remain fully stocked with advanced regeneration and pole size timber. The channel surveys completed by DNRC in 2011 do not indicate that there is any evidence of existing channel instability due to increased water yields or increased magnitude or duration of peak flows. Channel stability throughout most of the watershed was rated as being in relatively good and stable condition. Potential downstream impacts of increased water yields are also mitigated by the fact that the unnamed tributary flows into a directly into a small reservoir on Wallace Creek.

3.2 Geology and Soils

3.2.1 Geology and Soils Analysis Area & Methods

All proposed harvest areas and proposed road locations within the Project Area were field reviewed to assess soil conditions, harvest and road construction limitations, and to design mitigation measures to reduce potential soils resource impacts. Proposed harvest areas that were previously harvested were evaluated to determine the level of existing soils disturbance and impact using ocular assessments and walk-though evaluations. The analysis will consider both existing impacts to soils within the Project Area and forecast potential impacts to soils that would result by proposed harvest activities. The analysis will assess the anticipated direct, indirect and cumulative effects to soils that would be the result of the proposed harvest activities.

3.2.2 Existing Conditions- Geology and Soils

Soils within the Project Section are predominately Evaro and Winkler Series with lesser amount of Ovando-Elkner and Repp Series soils also occurring in limited areas within the proposed harvest area (NRCS 1995). On north aspects, in that portion of the Project Section located in the Ashby Creek watershed, the soils are predominately Evaro gravelly loams. Evaro soils are very deep somewhat excessively drained soils formed in colluviums derived from argillite and quartzite belt rock. The surface layer of these soils has a high content of volcanic ash. Evaro soils are considered low risk for erosion (K factor 0.05-0.17).

The soils on south aspects, in that portion of the Project Section located in West Fork Cramer Creek and the unnamed tributary to Wallace Creek, the soils are entirely Winkler very gravelly sandy loams and Winkler gravelly loams The Winkler soils consist of very, deep somewhat excessively drained soils that formed in colluviums derived from argillite and quartzite. Winkler soils are considered moderate risk for erosion based on K Factor and for slopes ≥ 45% (K factor 0.02-0.15). The risk for machine compaction would be low to moderate and the displacement potential on steeper slopes (≥ 45%) would be moderate to high.

A small portion of the Project Area within the NE ¼ of the Project Section contains Ovando-Elkner rock outcrop complex soils. These are very deep excessively drained soils that formed in igneous colluviums. Ovando-Elkner soils are considered low risk for erosion (K factor 0.02-0.10).

In addition a small portion of the Project Area within the NW ¼ of the Project Section is located on Repp very gravel loam soil. Repp soils are very deep, well drained soils that formed in colluviums derived from argillite and limestone. Repp soils are considered low risk for erosion (K factor 0.05-0.15) (NRCS 1995).

A majority of the proposed harvest area has either not been previously harvested, or underwent light levels of historic harvest which exhibits no measurable levels of detrimental soils disturbance. Those areas with most recent activity are very limited and detrimental soil impacts are estimated at less than 5% of the harvested area.

Existing levels of fine and coarse woody debris are variable and dependant on aspect and habitat type. In general, the levels of woody debris on the north slopes within the Project Section are estimated at 10-15 tons per acres. On the south slopes the levels were estimated to average approximately 5-10 tons per acre.

No unstable slopes or sites with high risk of slope instability were observed within the Project Section.

Soil Interpretations Table S1 Kamas Point Timber Sale Section 16, T12N, R16W						
#	**Mapping Unit Name**	**Soil Description**	**Erosion Potential**	**Displacement hazard**	**Compaction Hazard**	Notes
36	Evaro gravelly loam, 8 to 30 percent slopes	Gr Silt Loam colluvium from argillites/qtz Volcanic ash Surface low clay content	Moderate K .17	Mod	Mod	Productive soils suited to larch and Douglas-fir. Avoid excessive disturbance of ash surface
37	Evaro gravelly loam, 30 to 60 percent slopes	Gr Silt Loam Colluvium from argillites / quartzite Volcanic ash Surface Low clay content	Moderate K .17	Mod to high on slopes >45%	Mod	Limit ground skid to slopes less than 45% Avoid excessive disturbance of ash surface
74	Ovando-Elkner-rock outcrop complex, 30-60 percent slopes	Mod. Deep Gr Sandy Loam Colluvium from igneous bedrock Volcanic ash Surface Low clay content, Some outcrops	Moderate K .15 Coarse Sands Igneous	Mod to high on slopes >45%	Low	Igneous/Granitic soils on cool north aspects are more productive than Winkler. Limit ground skid to slopes less than 45%
131	Winkler, very gravelly loams, 30 to 60 % slopes	Shallow-mod deep residuum & colluvium low clay content	Low, very coarse K .02	Mod to high on slopes >45%	Mod	Shallow-Mod depth soils with fractured rock at shallow depth, Limit ground skid to slopes less than 45%
133	Winkler gravelly loam, cool, 30 to 60 percent slopes	Shallow-mod deep residuum & colluvium low clay content	Low, very coarse K .02	Mod to high on slopes >45%	Mod	Shallow-Mod depth soils with fractured rock at shallow depth, northerly aspect cool and more productive than 131 .Limit ground skid to slopes less than 45%
91	Repp very gravely loam, cool, 30 to 60 percent slopes	Mod deep very gravelly loams from rocky limestone colluvium, low clay content	Low, coarse K .05	Mod to high on slopes >45%	Low	Limestone soils on cool north aspects are more productive than Winkler. Limit ground skid to slopes less than 45%

Erosion potential considers slope and **K** indicates the susceptibility of a soil to sheet and rill erosion (low 0.02 to high 0.69)

3.3 Fisheries

3.3.1 Fisheries Analysis Area, and Methods

There are no contiguous stream channels or streams supporting fisheries within the Project Section. Therefore the analysis area for fisheries only includes those segments of the East Fork of Ashby Creek and mainstream Ashby Creek that are located immediately adjacent to the existing roads (a portion of the Proposed Haul Route). These are the only stream reaches and corresponding fish habitat that is most likely to be affected by the proposed harvest activities. The analysis of potential effects to fisheries habitat considers the effects of proposed harvest activities that would affect watershed conditions. Potential impacts to water quality and water quantity will be used to qualitatively forecast potential modifications or impacts to fish habitat.

Fisheries Cumulative Effects Analysis methods

The fisheries cumulative effects area analysis will focus on potentially affected water resources and fisheries streams that would be affected by proposed harvest Activities, including proposed road construction in Section 16, T12N, R16W and use of existing roads with crossings of streams known to support fisheries. The analysis area for sediment delivery is limited to proposed harvest areas and roads that would be used for hauling. This includes in-channel and upland sources of sediment that could result from project activities.

3.3.2 Existing Condition- Fisheries

There are no continuous stream channels or streams supporting cold water fisheries within the Project Section. The only fisheries habitat that would be potentially affected by the proposed harvest activities are those segments of Ashby Creek and the East Fork of Ashby Creek that are located immediately adjacent to the Proposed Haul Route. Westslope cutthroat trout occur in the Ashby Creek drainage and are identified as a DNRC Sensitive Species. Eastern brook trout, a nonnative species, also occurs in the Ashby Creek drainage. Bull trout do not occur within the Ashby Creek drainage (MFISH 2011).

Existing conditions of fisheries resources within the Ashby Creek drainage include numerous adverse impacts. Nonnative eastern brook trout are known to competitively displace westslope cutthroat trout; however, the rates and locations of this impact throughout the drainage are not well understood. Impacts to fisheries habitats include direct sediment delivery at road-stream crossing sites and adjacent road prism locations (see section addressing Water Quality for a more detailed description of road sediment sources). In-stream sedimentation is also likely accelerated due to long-term grazing impacts. Sedimentation has largely been in the form of fine materials that:

1. Reduce spawning habitat quality.
2. Reduce habitat complexity, including pool depths and volume.
3. Contribute to increased peak seasonal stream temperatures.
4. Reduce macro invertebrate richness.

Acute, direct impacts to population connectivity is occurring at 3 or more culverts due to complete or partial fish passage at many flow levels.

The existing road along Ashby Creek (that is part of the Proposed Haul Route) crosses Ashby Creek at three locations, all in-stream culverts. These crossings are considered either partial or complete fish passage barriers at various flow levels. These fish passage issues are being addressed. The Ashby Creek Road Relocation Project (scheduled to be completed in 2013) will remove culverts that are fish passage barriers.

3.4 Noxious Weeds

3.4.1 Noxious Weeds- Existing Conditions

Noxious weeds occurring on existing access roads and within the Project Section are mostly knapweed (Centaurea maculosa), houndstongue (Cynoglossum officinale L) and spot infestations of thistle (Cirsium arvense). Knapweed (Centaurea maculosa) was found along roadsides as well as in some forested portions of the Project Section, primarily on southern aspects. Houndstongue was found mostly along roadsides along the Proposed Haul Route. Historic cattle grazing, timber harvest activities, and recreational uses, are most likely the reasons for the existing rate of spread of noxious weeds and the potential future spread and introduction of noxious weeds.

Overall impacts of noxious weeds within the Project Area are moderate. Weeds have spread across all ownerships over time mainly along roadsides. Weed seeds are dispersed by wind, traffic, livestock and wildlife. Open forest sites (predominantly on southern aspects) with multiple uses such as timber management and grazing are at greater risk for weed spread. These drier sites are predominantly Ponderosa pine and Douglas-fir series Habitat Types. Timber harvest can increase weed spread through ground disturbance. Reductions to forest cover can increase the amount (and relative amount) of grass and weed coverage, increases their vigor, competitiveness and occurrence over time. These drier grass sites then become increasingly vulnerable to noxious weed spread, as weeds out-compete grasses.

Since purchasing 32,210 acres (Potomac Land Acquisition, Nov.-2010) the DNRC has been conducting weed spraying, including.approximately 80 miles of road within the Union and Camas Creek drainages. In 2012 the DNRC began road-side weed spraying along the road up East Ashby Creek (approximately 6 miles). The DNRC plans to conduct road-side weed spraying along the Proposed Haul Route and within the Project Section in 2013.

3.5 Forest Vegetation- Existing Conditions

Introduction: A section of this Chapter 3.5 (3.5.1- 3.5.2) will consider past harvest activities, and current insect and disease conditions within the Project Section.
The remaining sections (3.5.3- 3.5.7) will consider multiple aspects (including Modeling) of current forest conditions compared to Historic forest conditions synonymous with Natural forest conditions and describing some relevant ecological conditions and relationships. This approach is consistent with the philosophy of the "coarse filter approach" for Biodiversity in the SLFMP and ARM for Forest Management.

3.5.1 Harvest History within the Project Section:

Missoula Unit Section Records indicate that there was timber harvested in 1957-58 and 1971 from the Project Section 16, T12N, R16W (640 acres). Through 1958 approximately 2,430,690 bd. ft. of timber was reported harvested, of which approximately 94% was Douglas-fir, 2% Spruce, 2% White fir (subalpine fir) and 1% Western Larch. Less than 1% of this was Ponderosa pine and lodgepole pine combined. In 1971 approximately 101,710 bd. ft. of timber was reported harvested, of which approximately 97% was Douglas-fir, 2 ½% White fir (subalpine fir) and ½% lodgepole pine. These two entry periods account for approximately 2,532,400 bd. ft. total.
Some of the Douglas-fir was harvested in the S 1/2 of the Project Section (Douglas-fir cover type, on southerly aspects), as evidence of stumps and cutting pattern remains; shelterwood cutting and individual tree selection was employed. Where shelterwood cutting was used (portion of SW ¼), abundant, good quality Douglas-fir saplings occur presently, as well as a larger diameter Douglas-fir overstory. A substantial part of the harvest occurred in the N1/2, N1/2 of the Project Section (although there is no evidence that harvest occurred within the NE ¼ of the NE ¼ of the Project Section). Harvest on the north side of the Project Section occurred as individual and group selection type harvest as well. Spruce and subalpine fir were harvested from mixed conifer types that occur on northerly aspects (and associated mesic draws). Harvest of overstory Douglas-fir (overstory removal) was employed within portions of these mixed conifer types. Currently within these mixed conifer stands there are saplings, poles and small sawlog size mixed conifer species (Douglas-fir, Subalpine fir, spruce and some Western larch). There is evidence of individual tree harvest (selection) that occurred within Western larch/ Douglas-fir type stands (on northerly aspects); primarily Douglas-fir was harvested. Within these areas the overstory (large diameter) Western Larch and lesser amounts of Douglas-fir is dominant. Beneath the overstory there is abundant Douglas-fir and some Western larch: seedlings, saplings and poles. Where the overstory is most abundant the regeneration, predominantly Douglas-fir is suppressed. Larger openings created by previous harvest favored Western larch regeneration that is more vigorous.

3.5.2 Forest Insect and Disease Conditions within the Project Section:

The following information was obtained from repeated field observations within the Project Area. Insect activity is monitored from aerial surveys conducted annually by the U.S. Forest Service (USFS); this data is shared cooperatively with the DNRC. Field verification of this data: observations of occurrences, population trends and corresponding effects to timber stands are routinely monitored on DNRC forested lands.

Douglas-fir beetle has caused mortality throughout the Project Section. Mortality increased through 2005. Populations are currently (since 2011) at endemic levels. Individual trees and small groups of Douglas-fir trees were killed throughout the Project Section. Douglas-fir infected with root rot pathogens is predisposed to beetle attack. Phaeolus schweinitizii root and butt rot is common throughout the Project Section.

Mountain pine beetle has caused widespread mortality in lodgepole pine throughout the Project Area (2008-2011 field observations). It is estimated that approximately 90% of lodgepole pine of sawlog size and an estimated ≥ 65% (approximately) of pole size trees will die as a result of Mountain pine beetle activity within the Project Section. The affected area is approximately 50-60 acres. These dead trees have very little commercial value now (and value is deteriorating rapidly) and cable harvest and transportation costs exceed expected future value at current "delivered to mill" values. Whereas prior analysis of capturing potential losses was considered; Right-of-way acquisition and road construction costs would have exceeded the value of volume that could have been harvested on the aforementioned 50-60 acres of lodgepole pine.

Stem and root rots: Evidence of rot has been observed to be common throughout the Project Section. Older age trees (mature – over-mature ≥ 100 years) are most noticeably affected. Fomes pini, Phaeolus schweinitizii (causes rot in both butt and roots) and Fomes laricis has caused substantial butt rot. Wood volume loss due to rot is most prevalent in older Douglas-fir. Western larch is infected with Fomes laricis and Fomes pini, however overall volume losses due to rot are less. Armillaria ostoyae root rot was observed south of the Project Section, causing mortality in pole and sapling size Douglas-fir trees (post overstory removal harvest on Private Land in Section 21, T12N, R16W). Armillaria ostoyae could spread towards the Project Section from within Section 21 via root to root contact of susceptible Douglas-fir, this would be problematic.

Spruce budworm is defoliating both Douglas-fir and subalpine fir throughout the Project Area. Although it has been present, mining buds and old needles for three years it has not killed many trees. What little mortality that has occurred has been confined to relatively minor amounts of shade tolerant species (predominantly subalpine fir), suppressed understory saplings and poles size trees.

3.5.3 Stand Structure and Stocking Levels within the Project Section

Within the Project Section there are 640 acres of forested land and they are stocked. According to the Stand Level Inventory (SLI) approximately 99% of the stands are multi-storied structures. Approximately 57% of stands are well stocked

(≥70% crown closure) and 43% of stands are medium stocked (40-69% crown closure).

3.5.4 Desired Future Conditions (DFC): Forest Cover Types

The Stand Level Inventory Model describes an Appropriate Cover Type Condition synonymous with the Desired Future Condition (DFC) (ARM 36.11.405).

3.5.4.1 Project Area Forest Cover Types and DFC

Table 3-1: Project Section Current Cover Type Condition and Desired Future Condition (DFC). The data source for the following tables is the DNRC Stand Level Inventory (SLI) 1-12-2011.

COVER TYPE	Pre-Treatment		Post-Treatment		DFC	
	Acres	Percent	Acres	Percent	Acres	Percent
Douglas-fir	440	69	503	79	388	61
Western larch/Douglas-fir	32	5	42	6	179	28
Subalpine fir	109	17	36	6	0	0
Lodgepole pine	59	9	59	9	73	11
TOTAL	640	100%	640	100%	640	100%

Table 3-1 shows Current Cover for the Project Section compared to the DFC. It also shows the predicted Cover Type shift that would occur as a result of the proposed harvest.

At the Project level there are limited opportunities to help trend stands toward the DFC through potential cover type shifts (see Table 3-1). Most notably there are 109 acres currently (and inappropriately) excess acres in the Subalpine fir Cover Type and not enough acres (currently and appropriately) in the WL/DF Cover Type (179 ac. DFC minus 32 ac. Currently = 147 acres less than appropriate). Table 3-1 shows that within the Project Section (640 acres), currently 69% of the area (440 acres) is the Douglas-fir Cover Type. Within this type there are 13 stands: 2 of which have a trace (less than ≤ 9%) of ponderosa pine, 5 stands that have a representation of lodgepole pine (3 stands with trace amounts and 2 with 10-19%) and 6 with trace amounts of Western larch. For those Stands that are Currently Subalpine fir (109 acres): a 72 acre stands has trace amount of Western Larch and a 10 acre stand has 30% coverage of Western larch. Of the remaining 27 acres currently Subalpine fir, only approximately 3 acres are proposed for harvest.

Project level analysis of the DFC: Forest Cover Type Condition:
The SLI data was queried to see if Current Cover is not equal to DFC, Table 3-2 below.

Table 3-2: Kamas Point Cover Types Currently not equal (≠) to the Desired Future Condition; and predicted Cover Type Shift resulting from Proposed Harvest Treatment.				
Acres	**Current Cover Type**	**DFC Cover Type**	**Post-harvest Cover Type**	**Acres Proposed for Harvest**
13	**Douglas-fir**	**Lodgepole pine**	**Douglas-fir**	**9**
27	**Subalpine fir**	**Douglas-fir**	**Subalpine fir**	**3**
72	**Subalpine fir**	**WL/DF**	**Douglas-fir**	**60**
11	**Douglas-fir**	**WL/DF**	**Douglas-fir**	**4**
23	**Douglas-fir**	**WL/DF**	**Douglas-fir**	**9**
19	**Douglas-fir**	**WL/DF**	**Douglas-fir**	**15**
12	**Douglas-fir**	**WL/DF**	**Douglas-fir**	**11**
10	**Subalpine fir**	**WL/DF**	**WL/DF**	**10**
187 acres				**121 acres**

Table 3-2 shows individual Stand Current Cover Type conditions (where Current ≠DFC) in more detail and helps identify Stands where reducing amount of Subalpine fir and Douglas-fir present could potentially move them towards the DFC. The 13 acre Douglas-fir stand occurs on the far West side of main ridge top (N and SW aspect), all other stands in Table 3-2 are located on Northerly aspects, where Western larch a seral component occurs in limited coverage amounts and Subalpine fir is the indicated Climax species.

3.5.4.2 Missoula Unit Forest Cover Types and DFC

The area of consideration for the analysis of the DFC for **classified forest** cover types is 92,796 acres (net approximately, this excludes area of roads and lands classified non-forest), SLI data 1-12-2011. This data includes that for forested lands purchased by the DNRC from The Nature Conservancy (TNC) in November of 2010, approximately 32,210 acres (previously owned and managed by Plum Creek Timber Company).

Table 3-3: <u>Missoula Unit</u> Cover Types Currently not equal to the <u>Desired Future Condition</u>						
Current Cover Type			**Desired Future Cover Type**			**Difference**
Cover Type	**Stands**	**Acres**	**DFC**	**Stands**	**Acres**	**Acres**
Douglas-fir	**232**	**5,645**	**Douglas-fir**	**51**	**1,138**	**+4,507**
W. Hemlock	**7**	**250**	**W. Hemlock**	**2**	**51**	**+199**
Lodgepole pine	**57**	**1,699**	**Lodgepole pine**	**35**	**930**	**+769**
Mixed Conifer	**208**	**6,983**	**Mixed conifer**	**10**	**339**	**+6,644**
Ponderosa pine	**102**	**2,301**	**Ponderosa pine**	**504**	**14,282**	**-11,981**
Subalpine fir	**135**	**4,205**	**Subalpine fir**	**6**	**499**	**+3,706**
W. larch/DF	**168**	**4,731**	**WL/DF**	**428**	**12,796**	**-8,065**
W. White pine	**2**	**33**	**W.White pine**	**21**	**765**	**-732**

Table 3-3 shows the Current Cover Type (number of stands and acres for each Cover Type) and the corresponding Desired Future Condition (number of stands and acres for each Cover Type) for each of the Forest Cover Types. The Difference (in) Acres column shows the difference in acres between Current Cover and DFC Cover Types. Plus acres values for any given Forest Cover Type indicate excess Current Cover when compared to the DFC (Current Cover minus DFC). Minus acres values for any given Forest Cover Type indicate insufficient Current Cover when compared to the DFC (DFC minus Current cover).
In addition Table 3-3 shows (see Difference in Acres column) that there are insufficient acres for the following Cover Types: Ponderosa pine (PP, -11,981 ac.), Western larch/ Douglas-fir (WL/DF -8,065 ac.) and Western White pine (WWp -732 ac.). Most notably Table 3-3 shows excess acreage in the Douglas-fir, Mixed Conifer and Subalpine fir cover types (+4,507, +6,644, +3,706 respectively). These types of changes could be indicative of a lack of disturbance such as naturally occurring fire. This may suggest that fire suppression and lack of disturbance has allowed these stands to move towards a climax condition where shade tolerant species are likely to perpetuate on the site. Stands such as these are at risk to stand replacement fire and insect attack. Left alone (as a result of excluding fire or change) these stands would move towards a climax condition where the shade intolerant, fire dependant species (such as Western larch and Ponderosa pine) would be replaced over time by shade tolerant species.

3.5.5 Age Class Distributions:

Losensky's report: "Historical Vegetation of Montana" 1997, summarized United States Forest Service (USFS) inventory data dating back to the 1930's. From this data some extrapolations were made so as to quantify historic forest conditions by back dating to 1900, which generally would reflect stand conditions at the time of Euro-American arrival (Losensky 1997).

Table 3-4: Historic* and Current Age Class distributions:

Analysis Areas:	**Percent of Area by Age Class Groups**			
	0-39	**40-99**	**100-149**	**150+**
Missoula Unit Historic*	**35%**	**24%**	**18%**	**23%**
Missoula Unit Current	**17%**	**32%**	**43%**	**8%**
Kamas Point Project Section Current	**0%**	**11%**	**8%**	**81%**

***Historic Age Class Distributions:** Because the Missoula Unit occupies two Climatic Sections, a weighted average of the Historic Age Class distributions for Climatic Sections M333D and M332B (as reported by Losensky, B.J. 1997) was calculated to determine the Historic Age Class distribution for the Missoula Unit (Spoelma, T., DNRC: Memorandum to Deer Creek Timber Sale Project and EA 2010).

Comparison of Historic Age Class Distributions to:

1) Kamas Point Project Section: Table 3-4 shows that the Kamas Point Project Section has considerable more area occupied by the 150+ Age Class Group than reported by Losensky (81% compared to 23% respectively).

2) Missoula Unit: Table 3-4 shows that Missoula Unit has a greater proportion (approximately twice as much) of area in the 100-149 Age Class than occurred historically. Additionally Table 3-4 shows that Missoula Unit has approximately a third of the area occupied by stands in the 150+ Age Class, than reported by Losensky. On Missoula Unit the age class distribution (post 12-2010 purchase of approximately 30,600 net acres) changed as a result of increasing its land base by approximately 46% with stands of which 98% are classed as ≤150+ years. See Table 3-5 below.

Table 3-5: Age Class Distribution of lands acquired December 2010 from TNC			
Percent of Area by Age Class Group:			
0-39	**40-99**	**100-150**	**150+**
22%	**43%**	**32%**	**2%**

Table 3-6 shows to what extent Project Section Age Classes would be affected by the Proposed Harvest as a percentage of the proposed harvest Area. Approximately 84% of the proposed harvest would occur in Stands estimated to be greater than 150 years old (which occupy 81% of the Project Section, see Table 3-4).

Table 3-6: Age Classes affected by Proposed Harvest (% of Proposed Harvest Area)			
40-99	**100-150**	**150+**	***Potentially* Old Growth (*SLI Model estimate*)**
6%	**10%**	**80%**	**4%**

3.5.6 Old Stands and Old Growth Potential within the Project Section:

Old Stands (stands classed as 150+ years and older) throughout the Project Section were stratified and sampled using SLI Protocols to determine the potential of Old Growth (as defined by Green et. al 1992). As per SLI protocols assignments are made to determine minimum Green et al criteria (Old Growth Type Class) for each stand based on Habitat Type (Forest Habitat Types of Montana, Pfister et al) and Current Cover Type. For the Habitat Types and Cover Types (DF and WL/DF) within the Project Section, there are three Old Growth Types (as defined by Green et al) with the following criteria:

1. 8 tpa ≥ 21" ≥ 170 years.
2. 10 tpa ≥ 21" ≥ 180 years.
3. 10 tpa ≥ 17" ≥ 180 years.

Whereas Old stands were sampled plot data is somewhat inconclusive. Rot encountered made age determination problematic; consequently some data

indicated that the age to diameter correlation is unreliable for some stands (i.e. as in a 49 ac. stand); this conclusion may not necessarily be certain for all stands sampled. For some stands sampled it would be necessary to assume that at least a portion of large diameter trees that were sampled and were found to be rotten (unable to verify age) count towards satisfying minimum Old Growth requirements (as defined by Green et.al. 1992). In other stands (i.e. 84 ac. stand) some large diameter trees sampled (even after adding 10 years to age, estimated by boring trees at 41/2' above ground, up-hill side of tree and counting growth rings) where estimated to be not yet old enough to count towards satisfying minimum Old Growth requirements (as defined by Green et.al. 1992). Even so for this 84 ac. stand sufficient large diameter trees would be retained by the proposed harvest. A stand sampled (18 ac.) did not have sufficient large diameter trees, including trees with rot; this stand would not be prioritized, nor would all large diameter trees be retained.

Old stands were identified as Potential Old Growth. Potential Old Growth refers to stands that are Old and estimated to satisfy one of the following conditions:

1. Currently meet Green et al Old Growth Criteria.
2. Have a high probability of meeting Green et al Old Growth Criteria.
3. Would or could soon (within 10-20 years) meet Old Growth Criteria.
4. Have sufficient good quality large diameter trees with better than poor vigor.

It is estimated that within the Project Section there is approximately 230 acres of Potential Old Growth. The proposed harvest would affect 160 acres representing 43% of the proposed harvest area. These Potential Old Growth stands would receive Old Growth Maintenance treatments. Within these Potential Old Growth stands it is estimated that there are sufficient large diameter trees, to favor retention of such trees (especially Western larch), with better than poor vigor, in sufficient numbers (as defined by Green et.al. 1992), regardless of age verification. Maintenance treatments for these potential Old Growth Stands would be applied consistently with those prescribed for mixed severity fire regimes (ARM 36.11.418).

3.5.7 Effects of Fire Suppression and the Role of Naturally Occurring Fire on Forested Landscapes:

Through the emulation of natural processes, the DNRC endeavors to manage for biologically diverse forests (ARM 36.11.405).
Effective fire suppression has led to the establishment of dense regeneration, with a higher proportion of shade tolerant species such as Douglas-fir and subalpine fir. With the absence of fire, forests can become overstocked and stagnated. Fuel accumulations increase as trees die from competition and environmental stresses. Overstocking and the associated stress due to competition between the trees for moisture and nutrients can lead to increased attack by insects such as the mountain pine beetle, pine engraver beetle and Douglas-fir beetle. The development of an understory of Douglas-fir and or subalpine fir forms a very

effective fuel ladder that enables a surface fire to climb into the crowns of the larger overstory trees and kill them. High fuel loadings and dense stand conditions have led to high intensity, stand replacing wildfire in stands where they were uncommon in the past (Arno and Brown 1991).
A forest's response to fire is dependant on various forest attributes (stand age, structure, size class, stocking, and species composition), within the context of various environmental conditions. When a fire starts, it is fuels, weather and topography (including but not limited to: temperature, humidity, fuel load, fuel moisture, wind, elevation, slope, aspect etc), that determines how a particular forest condition is affected. Figure 1 shows the relative resistance of conifers to fire. Seral (shade intolerant species) are generally more resistant to fire effects.

Figure 1: Relative Degree of Resistance to Fire				
Most resistant	Very resistant	Medium	Low	Very low
Western larch	Ponderosa pine Douglas-fir	Grand fir Lodgepole pine Western white pine Western red cedar	Spruce Hemlock	Subalpine fir

Project Section Habitat Types and Fire Groups:
Habitat Types (HT) within the Project Section are associated with Fire Groups 6, 8 and 9 as defined by Fischer and Bradley (1987), (46.4%, 17.2% and 36.4% of the Project Area, respectively).

Table 3-7: Project Section Habitat Types and Fire Groups:

Habitat Types (as defined by Pfister et. al. 1977) and corresponding **Fire Groups** (as defined by Fischer and Bradley 1987); source of data: Stand Level Inventory (SLI) 1-12-2011

Kamas Point Section 16, T12N, R16W

Habitat Type	Number of Stands	**Sum Acres**	**Fire Group** Number and Description	Number of Stands	**Sum Acres**	**Percent of Area**
PSME/VAGL-VAGL	3	86	6- Moist- Douglas-fir	6	297	46.4 %
PSME/SYAL-CARU	3	211				
ABLA/LIBO-XETE	3	42	9-Moist-Lower-Sub-Alpine fir	9	233	36.4 %
ABLA/MEFE	6	191				
ABLA/XETE-VAGL	5	110	8-Dry-Lower-Sub-Alpine fir	5	110	17.2 %
TOTALS:		640			640	100 %

The following descriptions of Fire Groups are those of Fischer and Bradley (1987).

For forests in Fire Group 6, Douglas-fir is both the indicated climax species and a vigorous member of the seral (shade intolerant species) component. It is not uncommon for Douglas-fir to dominate all stages of succession. Ponderosa pine, western larch, and lodgepole pine, where they occur are seral components whose abundance varies by phase. Fire history studies conducted within the PSME/CARU Habitat Type of Southwestern Montana indicate a mean fire interval of 42 years, for pre-settlement stands. Fire was an important agent in controlling density and species composition. Low to moderate severity fire converted dense stands of pole-sized or larger tress to a more open condition, and subsequent light burning maintained stands in open conditions. Frequent low intensity or moderate fires favored western larch and ponderosa pine over Douglas-fir where these species occurred. Severe fires probably occurred on sites with ladder fuels (seedlings and saplings that allow surface fires to move up into the overstory canopy), dense stand conditions, and heavy fuel loads that resulted in stand replacement. Stand replacement fires favored lodgepole pine on sites where this species was present. Fire's role as a stand replacement agent becomes more pronounced when the natural fire-free interval is increased through fire suppression (unless corresponding fuel reduction occurs). The theoretical climax condition for Group 6 is a multistoried Douglas-fir stand, although a fire-maintained open forest condition was the normal situation during the pre-settlement period. Frequent low to moderate severity fires that occur in the climax condition of these sites, will create a more open, park-like stands of Douglas-fir, whereas a severe fire returns the stand to the grass, shrub and forbs stage (Fischer and Bradley 1987).

The general pattern of forest succession for Fire Group 9 (36.4% of the Project Section) is as follows. Douglas-fir, lodgepole pine, and western larch are seral components, whereas subalpine fir, spruce and to a lesser extent mountain hemlock are the climax species (shade tolerant) associated with these fire groups. Fisher and Bradley found that the mean fire return interval for Fire Group 9 was approximately 90-130 years. Forested stands experienced mixed severity fire effects, where some or all trees were killed by fire. As a result a variety of stand conditions were likely to occur throughout the range of these fire types. Multi-storied mixed conifer forests, and Western larch/ Douglas-fir forests, and fire maintained lodgepole pine stands are common for these fire groups. Reoccurring stand replacement fires favored the regeneration of lodgepole pine on sites where this species was present. Multi-storied mixed conifer stands are vulnerable to severe fire effects because of the potential high fuel loading and the increased presence of shade tolerant ladder fuels. Climax stands within Fire Group 9 are very susceptible to stand replacement fire.

The general pattern of forest succession for Fire Group 8 is similar to that of Group 9. Both groups share many of the same seral and climax tree species, and so have much the same fire response. The major difference between the two is that the drier Group 8 stands experience more frequent, generally less severe fires than Group 9 stands (Fischer and Bradley 1987).

Fire's role as a stand replacement agent becomes more pronounced when the natural fire-free interval is increased through fire suppression, unless corresponding fuel reduction occurs. High fuel loadings and dense stand conditions have led to high intensity, stand replacing wildfire in stands where they were uncommon in the past (Arno and Brown 1991).

3.6 Air Quality

3.6.1 Characteristics of Smoke in the Potomac Valley

The Project Section is located approximately 6 miles south of Potomac. The mountain valleys of Western Montana are prone to cold air inversions in the fall and winter when stationary high-pressure systems create a stable air mass that traps pollutants in the valley bottom. During the spring season the atmosphere is much more unstable and stable cold air does not settle into the valleys to the extent it does in the fall or winter. Due to this atmospheric instability, smoke is transported out of the valley much better in the spring than in the fall. (Turah Creek EA, MT DNRC 2002)

3.6.2 Regulation of Open Burning

Missoula County is a PM-10 Non-Attainment area as designated by the Environmental Protection Agency and the Montana Department of Environmental Quality. Open burning is allowed in Missoula County from March 1 to August 30 of each year. From September 1 to November 30 burning is permitted for forestry purposes only. No burning is allowed from December 1 to February 28. The Montana DNRC is a member of the Montana-Idaho Smoke Management Group. This group is composed of the major forestry burners in Idaho and Montana. Members of the group report their planned burns to a monitoring unit in Missoula before they are ignited. The goal of the smoke monitoring unit is to prevent the average PM-10 level for a 24 hour period from exceeding 50 milligrams per cubic meter of air. Idaho and Montana are divided into "airsheds" which are geographic areas with similar topography and weather patterns. Urban areas within these airsheds are designated as impact zones. Due to the potential for adverse impacts to air quality in urban areas, burning in these impacts zones is much more restrictive than the airshed it is located in as a whole. The Project Area is located in Airshed 3A as designated by the Montana/Idaho Airshed Group. The Montana/Idaho Airshed Group Monitoring Unit issues daily smoke dispersion forecasts and burning restrictions for each airshed and impact zone. Restrictions are based on the number of burns planned, their location and atmospheric conditions. These restrictions are designed to limit the adverse impact to air quality resulting from prescribed burning. (Turah Creek EA, MT DNRC 2002)

3.6.3 Road Dust

The use of unpaved roads can produce dust when road surfaces are dry. There has historically been log truck and mining activity related traffic on Morrison Lane, Ashby Creek Roads (East and West Fork), and including other roads within the Project Area. Traffic associated with activities on private timberlands, Bureau of

Land Management ownership, and DNRC Lands all have the potential to generate dust. Dust is presently produced by log trucks and passenger vehicle traffic along roads that would be used for log hauling purposes associated with this project. The DNRC (2011) scoped adjacent landowners (to the Project Area) and residents along the Proposed Haul Route: Morrison Lane, Ashby Creek Road and East Ashby Creek Road. Concerns were expressed regarding maintaining the Missoula County Maintained portion of Morrison Lane (graveled surface) and potential dust resulting from use of this road segment associated with Proposed Timber Sale Activities. The DNRC has no obligation to maintain (nor require maintenance on its behalf) County Maintained road segments. Missoula County maintained (shaped and performed dust abatement) the graveled portion of Morrison Lane in the spring of 2011 and 2012. Missoula County protects roads from damage, by placing weight limits (limiting heavy truck traffic) during periods (i.e. "spring break-up") when roads are susceptible to damage from heavy truck traffic.

Beyond (south of) the Missoula County maintained potion of Morrison Lane there are no residents immediately adjacent to the Proposed Haul Route, on the existing road that continues up (south along) Ashby Creek and the East Fork of Ashby Creek.

3.7 Recreational Use

Snowmobile use is common within the Garnet Mountains and in part is managed through the Bureau of Land Management's Garnet Winter Recreational Trails System; however the Proposed Haul Route is not managed as part of the aforementioned system. No motorized use is allowed on roads that are gated, that otherwise could provide access to the Kamas Point Section. Hunting is another common and traditional use of lands within the Garnet Mountains and within the Project Area; although motorized access to the Kamas Point Section is restricted. Non- motorized use such as walk-in hunting is allowed, and there are gates in Section 9,13, 20 and 21, T12N, R16W that restricts motorized access to the east (approximately 3 miles), west, south and north (approximately ½ mile, 1 mile and 1 mile respectively) from the boundaries of the Kamas Point Section (see map preceding Chap. 1).

3.8 Economics

Table 3-8: Revenue/ Cost Ratios

	FY 2007	FY 2008	FY 2009	FY 2010
State	1.79	2.50	1.88	1.63
NWLO	2.32	3.07	3.20	2.85
SWLO	2.12	4.05	1.72	1.78

Table 3-8 illustrates an annual cash flow analysis conducted on the DNRC trust land forest management program for the fiscal years 2007 - 2010. Revenues and costs are monitored at the land office and statewide program levels. Revenue-cost

ratios (R/C) are a measure of annual program cash flows comparing revenues earned, and expenses charged within the fiscal year accounting period.

Table 3-9: FY 2010 Forest Management Operations Summary

	Revenues	Expenses	Net Income	R/C Ratio	FI Collections	FI Expenses
State	$8,044,850	$4,943,408	$3,101,442	1.63	$1,205,781	$1,613,731
CLO	$128,035	$199,649	-$71,614	0.64	$44,415	$10,879
ELO	$0	$16,282	-$16,282	0.00	$0	$0
NELO	$38,840	$47,581	-$8,741	0.82	$1,596	$0
NWLO	$5,787,034	$2,027,219	$3,759,815	2.85	$798,708	$565,950
SLO	$0	$0	$0	0.00	$600	$0
SWLO	$1,763,856	$990,008	$773,848	1.78	$360,461	$259,668

Table 3-9 shows the FY 2010 annual summary of revenue and costs for the trust land forest management program. Values in this table represent a fiscal analysis not an economic analysis. This is because forest management revenues are earned multiple years after sales are planned, prepared and contractually executed, hence revenues and costs are not operationally relative in one given fiscal year. Table 3-9 presents total costs and revenues by land office and for the statewide program in total. The overall revenue-cost ratio statewide is 1.63 in FY 2010, the lowest in the last four years. This current low program revenue-to-cost ratio is a product of increased program expenses due to the accounting movement of FI personal services into the main forest management program. On the revenue side, timber sale bid prices have decreased significantly due to structural changes in the U.S. housing and home construction markets. Reduced demand for timber resources has consequently lowered the overall forest management revenues.

Table 3-10: New Timber Sale Contract Value (estimated): 2012 U.S. Dollars Reported by DNRC's Forest Management Bureau						
Quarter and Year						
Quarter and Year	Q1- 2011	Q2- 2011	Q3- 2011	Q4-2011	Q1-2012	Q2-2012
Land Office						
CLO			$740,489			
ELO		$13,234				
NELO		$7,655	$9,503	$38,220		
NWLO		$1,553,670	$793,445	$275,107	$206,008	$4,332,063
SWLO	$1,015,711	$825,780	$241,572	$179,532	$346,422	$360,783
Totals:	$1,015,711	$2,400,349	$1,785,008	$492,860	$552,430	$4,692,847
Mean Value/ MBF	$129	$134	$104	$117	$118	$177

Montana "delivered to mill" sawlog prices have generally increased slightly (trended upward) since bottoming out third Quarter 2009; based on data available from the Bureau of Business and Economic Research, University of Montana.

Table 3-11: Forest Management Gross Revenues by Fiscal Year (FY)					
Source:	FY 2007	FY 2008	FY 2009	FY 2010	FY2011
Timber Sales:	$7,482,894	$10,000,724	$7,584,556	$8,044,850	$8,615,896
Forest Improvement Collections:	$1,316,404	$1,098,577	$868,511	$1,196,307	$1,880,335
Totals:	$8,799,298	$11,099,301	$8,453,067	$9,241,157	$10,496,231

Source of data in Table 3-11is Trust Lands Management Division (TLMD) Annual Report FY2011, available on DNRC website http://dnrc.mt.gov/AboutUs/Publications/2011/TrustAr.pdf
This report details Administrative costs, other sources of Trust Land revenue and its distributions to beneficiaries.

3.9 Visual Quality

Far views defined herein are views of the Kamas Point Section 16, T12N, R16W (Project Section); that are visible from vantage points other than those within the Project Section. The result of past harvest adjacent to the Project Section on all sides has produced an abrupt edge effect. The North aspect of the Project Section can be seen from Highway 200 in the vicinity of Potomac which is approximately six miles distant. The far view of the North aspect from Highway 200 near Potomac is noticeable and does not appear to be natural. Although the adjacent lands are stocked with saplings and pole size trees, when viewed from a distance they still visibly contrast with the well stocked mature forests within the Project Section. The view (from afar) of the north aspect of the Project Section is most pronounced in winter. Immature trees on lands adjacent to the Project Section provide less snow intercept and have less crown density than the well covered forested Project Section. Thus, it is when there is snow in the areas surrounding the Project Section that there is potentially the greatest visual contrast with well stocked mature forests within the Project Section. Snow does at times accumulate in the crowns of forested Project Section diminishing the contrast between the Project Section and surrounding lands.

3.10 Wildlife

3.10.1 Mature Forested Habitats and Landscape Connectivity

A variety of wildlife species rely on mature to old stands for some or all life requirements. A partial list of these species includes pileated woodpeckers (*Dryocopus pileatus)*, American marten (*Martes americana*), brown creepers (*Certhia americana)*, and winter wrens (*Troglodytes troglodytes*). Wildlife species that require connectivity of forest habitat types between patches, or those species that are dependent upon interior forest conditions, can be sensitive to the amount and spatial configuration of appropriate habitats. Some species are adapted to thrive near patch edges, while others are adversely affected by the presence of edge, or the other animals that prosper in edge habitats. Connectivity of forested habitats facilitates movements of those species that avoid non-forested

areas and other openings; connectivity under historical fire regimes likely remained relatively high as fire differentially burned various habitats across the landscape.

The Project Section currently contains approximately 570 acres of mature stands (100-plus years in age) of primarily Douglas-fir stands that have a reasonably closed canopy. Currently, forested areas cover most of the Project Section facilitating some use by those species requiring connected-forested conditions and/or forested-interior habitats. On the DNRC-managed portions of the cumulative effects analysis area, roughly 1,344 acres of mature Douglas-fir and western larch habitats exist that have a reasonably closed canopy. Mature forested stands with a reasonably closed canopy make up a negligible component of the stands on other ownerships in the cumulative effects analysis area, which coupled with the network of restricted roads has reduced landscape-level connectivity.

3.10.2 Endangered Species:

3.10.2.1 Grizzly Bears (Federally threatened)

Grizzly bears are native generalist omnivores that use a diversity of habitats found in western Montana. Preferred grizzly bear habitats are meadows, riparian zones, avalanche chutes, subalpine forests, and big game winter ranges, all of which provide seasonal food sources. The search for food drives grizzly bear movements, with bears moving from low elevations in spring to higher elevations through the summer and early fall, as fruits ripen throughout the year. Primary habitat components in the Project Area include meadows, riparian areas, and big game winter ranges. Primary threats to grizzly bears are related to human-bear conflicts, habituation to unnatural foods near high-risk areas, and long-term habitat loss associated with human development (Mace and Waller 1997). Forest-management activities may affect grizzly bears by altering cover and/or by increasing human access into secure areas by creating roads (Mace et al. 1997). These actions could lead to the displacement of grizzly bears from preferred areas and/or result in an increased risk of human-caused mortality by bringing humans and bears closer together and/or making bears more detectable, which can increase the risk of bears being illegally shot. Displacing bears from preferred areas may increase their energetic costs, which may, in turn, lower their ability to survive and/or reproduce successfully.

The Project Area is approximately 19 miles south of the Northern Continental Divide Ecosystem grizzly bear recovery area, and approximately 13 miles southwest of occupied grizzly bear habitat (Wittinger et al. 2002). However, grizzly bears are increasingly being documented south of the recovery zone (J. Jonkel, MT FWP, personal communication, 2011) and recently grizzly bears have been documented within 5-6 miles of the Project Section in the Cramer Creek area (DNRC 2011). Although grizzly bears have not been documented in the Project

Section, use of the Project Section is possible. Grizzly bears generally use different habitats relative to season. The Project Area primarily provides mid-high elevation forested areas used during the summer. The cumulative effects analysis area encompasses roughly 32,285 acres. After recent acquisitions, DNRC manages approximately 48% (15,400 acres) of the cumulative effects analysis area.

Managing human access is a major factor in management for grizzly bear habitat. There are no open roads in the Project Section, but open road densities are relatively high in the cumulative effects analysis area (1.4 mi. /sq/ mi., simple linear calculation). No security habitats exist in the Project Area or cumulative effects analysis area. Hiding cover exists in the Project Area; recent timber management on adjacent ownerships has reduced grizzly bear hiding cover in the cumulative effects analysis area. Timber harvesting and human development that is occurring or has occurred on other ownerships likely altered grizzly bear habitats and/or human disturbance levels. Across the cumulative effects analysis area, the reductions in hiding cover, the elevated levels of human disturbance, and the mosaic of available habitats likely limits the overall usefulness of the cumulative effects analysis area for grizzly bears.

3.10.2.2 Lynx (Federally threatened)

Canada lynx are associated with subalpine fir forests, generally between 4,000 to 7,000 feet in elevation in western Montana (Ruediger et al. 2000). The proposed Project Area ranges from approximately 5,280 to 6,320 feet in elevation and is dominated by Douglas-fir. Lynx in western Montana preferred mature, multi-storied stands with dense horizontal cover year-round; during the summer lynx also selected earlier successional stands with a high horizontal cover (Squires et al. 2010). For denning sites, the primary component appears to be abundant large woody debris, particularly in the form of downed logs, root wads, slash piles, and live trees (Squires et al. 2008). These conditions are found in a variety of climax vegetation habitat types, particularly within the subalpine fir series (Pfister et al. 1977). Historically, high intensity, stand-replacing fires of long fire intervals (150 to 300 years) occurred in continuous dense forests of lodgepole pine, subalpine fir, and Engelmann spruce. These fires created extensive even-aged patches of regenerating forest intermixed with old stands that maintained a mosaic of snowshoe hare and lynx habitat.

Approximately 431 acres of lynx habitat occur in the Project Section. Much of this habitat was identified as winter foraging (390 acres), with lesser amounts of summer foraging (10 acres) and other suitable habitats (largely forested lands that provide cover to facilitate movement; 31 acres). Recent mortality in the lodgepole pine in a portion of the Project Section has increased coarse woody debris levels. Connectivity of forested habitats in the Project Section is relatively intact.

The cumulative effects analysis area is approximately 32,285 acres. After recent acquisitions, DNRC manages approximately 48% (15,400 acres) of

the cumulative effects analysis area. Potential lynx habitats exist on roughly 2,424 acres of DNRC-managed lands (15.7%) in the cumulative effects analysis area, including 1,815 acres of winter foraging habitats, 318 acres of summer foraging habitats, 169 acres of other suitable habitats, and 122 acres of temporary non-suitable habitats. Across the cumulative effects analysis area, the majority of the existing stands have been altered by timber management and other forms of human habitat modification in the recent past, likely limiting usefulness of the cumulative effects analysis area for lynx. Additionally, a fairly large portion of the cumulative effects analysis area supports dry ponderosa pine and Douglas-fir types, which are generally not highly suitable lynx habitats. In general, the cumulative effects analysis area likely contains marginal habitats and the limited amounts of winter foraging habitats that could support lynx in the winter, which likely limits the potential use of the cumulative effects analysis area by lynx.

3.10.3 Sensitive Species:

3.10.3.1 Fisher

Fishers are a mid-sized forest carnivore whose prey includes small mammals such as voles, squirrels, snowshoe hares, and porcupines, as well as birds (Powell and Zielinski 1994). They also take advantage of carrion and seasonally available fruits and berries (Foresman 2001). Fishers use a variety of successional stages, but are disproportionately found in stands with dense canopies (Powell 1982, Johnson 1984, Jones 1991, Heinemeyer and Jones 1994) and avoid openings or young forested stands (Buskirk and Powell 1994). However, some use of openings may occur for short hunting forays or if sufficient overhead cover (shrubs or saplings) is present. Fishers appear to be highly selective of stands that contain resting and denning sites and tend to use areas within 150 feet of water (Jones 1991). Resting and denning sites are found in cavities of live trees and snags, downed logs, brush piles, mistletoe brooms, squirrel and raptor nests, and holes in the ground. Forest-management considerations for fisher involve providing for resting and denning habitats near riparian areas while maintaining travel corridors.

There are approximately 43 acres of potential upland fisher habitats and no riparian habitats in the Project Section. Within 1-mile of the Project Section, there are approximately 126 acres of potential fisher habitats (including the 43 acres in the Project Section) on DNRC-managed lands and likely some additional habitats on a portion of the 484 acres of mature forest on adjacent ownerships in the cumulative effects analysis area. In the future, potentially suitable fisher habitats could develop on a portion of the 424 acres of preferred cover types on DNRC-managed lands that currently lack sufficient structure to meet habitat needs for fishers. In general, given the habitats present in the Project Section and cumulative effects analysis area, extensive use by fisher would not be anticipated.

3.10.3.2 Flammulated Owls

Flammulated owls are tiny, migratory, insectivorous forest owls that inhabit old, open stands of warm-dry ponderosa pine and cool-dry Douglas-fir forests in the western United States and are secondary cavity nesters. In general, preferred habitats have open to moderate canopy closure (30-50 percent) with at least 2 canopy layers, and are often near small clearings. They usually nest in cavities excavated by pileated woodpeckers or northern flickers in 12-25" dbh ponderosa pine, Douglas-fir, or aspen. Without disturbance, Douglas-fir encroach upon ponderosa pine stands resulting in increased stand density and decreased habitat quality for flammulated owls. Periodic, low-intensity under burns can increase habitat suitability and sustainability by reducing the density of understory seedlings and saplings, stimulating shrub growth, and by protecting large dominant trees from ladder fuels and competition with other mature trees.

There are approximately 212 acres of potential flammulated owl habitats in the dry Douglas-fir stands across the southern portion of the Project Section. Within 1-mile of the Project Section, there are approximately 1,097 acres of potential flammulated owl habitats on DNRC-managed lands (including those in the Project Section). Additionally, some suitable habitats likely exist on a portion of the 3,481 acres of open and closed forested habitats on other ownerships in the cumulative effects analysis area. A portion of those habitats in the cumulative effects analysis area have been harvested in the recent past, potentially improving flammulated owl habitat by creating foraging areas and reversing a portion of the Douglas-fir and ponderosa pine encroachment. Modern fire suppression has allowed Douglas-fir in-growth to create denser stands of ponderosa pine and Douglas-fir in portions of the cumulative effects analysis area, which has reduced habitat quality for flammulated owls.

3.10.3.3 Pileated Woodpeckers

The pileated woodpecker is one of the largest woodpeckers in North America and excavates the largest cavities of any woodpecker. Preferred nest trees are large diameter western larch, ponderosa pine, cottonwood, and quaking aspen trees and snags, usually 20 inches dbh and larger. Pileated woodpeckers primarily eat carpenter ants, which inhabit large downed logs, stumps, and snags. Aney and McClelland (1985) described pileated nesting habitat as "...stands of 50 to 100 contiguous acres, generally below 5,000 feet in elevation with basal areas of 100 to 125 square feet per acre and a relatively closed canopy." The feeding and nesting habitat requirements, including large snags or decayed trees for nesting and downed wood for feeding, closely tie these woodpeckers to mature forests with late-successional characteristics. The density of pileated woodpeckers is positively correlated with the amount of dead and/or dying wood in stands (McClelland 1979).

In the Project Section, potential pileated woodpecker nesting habitat exists on approximately 436 acres. These nesting habitats are dominated by Douglas-fir with a lesser amount of western larch and mixed conifers. Additionally, 197 acres of sawtimber stands dominated by Douglas-fir and lodgepole pine, which are potential foraging habitats, exist in the Project Section. Within 1-mile of the Project Section, an additional 29 acres of potential pileated nesting habitats exist on DNRC-managed lands; potential lower quality foraging habitats exists on roughly 1,575 acres of DNRC-managed lands in the cumulative effects analysis area. On other ownerships in the cumulative effects analysis area, potential pileated woodpecker nesting and foraging habitats likely exist on some of the 484 acres of mature forests. Much of the 2,997 acres of open forest and young forest on other ownership in the cumulative effects analysis area is likely too open for much use as foraging habitats for pileated woodpeckers. Collectively, pileated woodpecker habitats are fairly limited in the cumulative effects analysis area, and the cumulative effects analysis area likely could only support 1 pair of pileated woodpeckers.

3.10.4 Big Game

3.10.4.1 Big Game Winter Range

Winter ranges enable big game survival by minimizing the effects of severe winter weather conditions. Winter ranges tend to be relatively small areas that support large numbers of big game, which are widely distributed during the remainder of the year. These winter ranges have adequate midstory and overstory to reduce wind velocity and intercept snow. The effect is that temperatures are moderated and snow depths are lowered, which enables big game movement and access to forage with less energy expenditure than in areas with deeper snow and colder temperatures. Snow depths differentially affect big game; white-tailed deer are most affected, followed by mule deer, elk, and then moose. Montana Department of Fish, Wildlife, and Parks identified elk winter range on approximately 293 acres in the southern half of the Project Section. This area is part of the larger 3,797 acre winter range in the area. Winter snow depths and suitable microclimates influence big game distribution and use within the vicinity. Mature Douglas-fir and mixed conifer stands in the Project Section are providing attributes facilitating use by wintering big game. Ongoing mortality in the lodgepole pine in a portion of the Project Section is altering thermal cover and snow intercept. Given the elevation of the Project Section, the habitats present, and the habitats on surrounding lands, extensive winter use of the Project Section by big game is unlikely. Evidence of non-winter use by deer and elk was noted throughout the Project Section during field visits.

Presently, roughly 702 acres in the 3,797-acre winter range used for the cumulative effects analysis area appear to be providing thermal cover and snow intercept for big game, including approximately 264 acres in the

Project Section. In the recent past, much of the winter range has been harvested, which removed most of the thermal cover and snow intercept capacities, but could start developing some thermal cover and snow intercept capacities within the next 30-60 years. Minor levels of human disturbance would be anticipated in the winter range.

3.10.4.2 Elk Security Habitat

Timber harvesting can increase elk vulnerability by changing the size, structure, juxtaposition, and accessibility of areas that provide security during hunting season (Hillis et al. 1991). As visibility and accessibility increase within forested landscapes, elk and deer have a greater probability of being observed and, subsequently, harvested by hunters.

Areas that are within 0.5 mile of an open road do not provide elk security habitat. Approximately 383 acres in the Project Section are part of a 10,671-acre patch of area that is more than 0.5 miles from open roads in the cumulative-effects analysis area. Additionally, hiding cover, which is the other component of elk security habitat, is abundant in the Project Section, but is being reduced on a small portion of the Project Section with the ongoing mortality in the lodgepole pine. Within the cumulative effects analysis area, there are a total of 3 blocks that are more than 0.5 mile of open roads. Hiding cover varies in those blocks with the recent modifications from timber management, but the combination of topography, distance from open roads, and the presence of regenerating vegetation likely provides adequate cover for elk during the hunting season. Low to moderate levels of hunter access exist in the Project Section; restricted roads (approximately 1.8 miles/sq. mile) facilitate non-motorized access and illegal motorized access. In the 32,285-acre cumulative effects analysis area, access for recreational hunting is widespread, with several open roads (at least 69 miles, 1.4 miles/sq. mile) that facilitate access and numerous restricted roads (at least 241 miles; 4.8 miles/sq. mile) that are used for non-motorized use.

4.0 Environmental Consequences

Introduction

Chapter 4: Environmental Consequences describes the direct, indirect, and cumulative effects of the proposed action on various resources within the analysis area.

4.1 Water

4.1.1 Alternative A: No Action, Direct and Indirect Effects on Water

The Ashby Creek Road Relocation Project (located in Section 3, T12N, R16W) has been implemented. When completed in 2013, approximately 5000 feet of existing road that is located immediately adjacent to Ashby Creek will have been abandoned and rehabilitated. The new road (replacement) being constructed is located away (upslope) from the stream channel and out of the floodplain. Two culverts will be removed from the segment of road being abandoned. The new bridge located above the Fork of East and West Ashby replaces the existing crossing (culvert) at the Fork of East and West Ashby Creeks. The Ashby Creek Road Relocation Project will mitigate long-term chronic sediment delivery problems. The new road location is designed to fully meet BMPs and is considered a low risk for sediment delivery. A moderate amount of short-term sediment delivery is expected to occur during road obliteration, culvert removal and stream channel restoration activities. While short-term impacts to water quality are anticipated, they are expected to be relatively minor in magnitude and duration when compared to the ongoing, existing levels of direct, indirect and cumulative sedimentation to Ashby Creek. Following the completion of the Ashby Road Relocation Project, the long-term direct, indirect and cumulative risks of impacts to water quality will be greatly reduced from that occurring under the existing conditions.

4.1.2 Alternative B: Harvest, Direct and Indirect Effects on Water

BMPs would be incorporated by design and employed (implemented) for all proposed harvest activities (see Mitigations Chap 2.5.1-3). All applicable BMPs would be implemented during road maintenance and road improvement activities to minimize the potential for erosion and sediment delivery. Improvements would be made to existing roads that would be used to haul forest products. These improvements would include road surface drainage improvements: shaping road surfaces, the construction and reconstruction of drain dips, installing rubber water diverters, and providing sediment filters at road surface drainage feature outlets. Road maintenance would be conducted concurrent with hauling operations. Erosion control measures would be utilized on roads and within harvest areas, concurrent with operations. Improvements to the existing road located immediately adjacent to the East Fork of Ashby Creek would reduce sediment delivery to this stream segment.

Improvements to the Proposed Haul Route from both the Ashby Road Relocation Project and the Action Alternative are expected to reduce sediment delivery to both Ashby Creek and the East Fork of Ashby Creek. However, low levels of short-term sediment delivery can be expected during and shortly after (one year) road maintenance and improvement activities occurring immediately adjacent to the East Fork of Ashby Creek. In addition, even with all the proposed improvement to the existing road, it is unlikely that the 2.45 mile segment of existing road located immediately adjacent to the East Ashby Creek can be upgraded to fully meet BMPs. A moderate risk of low levels of sediment delivery to the stream occurring during the proposed timber hauling activities would likely remain. While, sediment delivery risk would be reduced from the current existing conditions, it is unlikely that risk would be reduced to a low level due to the road's close proximity to the stream and the lack of adequate filtration zones in many locations.

The Action Alternative includes construction of approximately 5 miles of new road, the majority of which would be located within the Project Section. Approximately 750 feet would be constructed within Section 15, T12N, R16W. New roads would be located on moderate slopes, near ridge tops, and well buffered from streams. The proposed Lower Road that would be located on the north aspect of the Project Section would traverse several ephemeral draws. These ephemeral draw crossings would require moderately deep fills (3-5 feet) and 18"culverts would be installed. All applicable BMPs would be implemented during new road construction activities to minimize the potential for erosion and sediment delivery. Some low levels of short-term sediment delivery to these ephemeral draws can be expected during and shortly after (1 to 2 years) road construction and installation of culverts. The risk of actual down slope sediment delivery to streams would be low due to the discontinuous nature and well vegetated sediment filtration capacity of these ephemeral draw features.

The proposed harvest would occur on approximately 370 acres. Approximately 250 acres would be harvested with ground based equipment and 120 acres would be harvested utilizing cable yarding systems.
The proposed harvest, including site preparation and slash disposal activities are all expected to be a low risk for direct and indirect impact to water quality. The proposed harvest areas are located on moderate slopes with low to moderate erosion potential. No unstable slopes or areas prone to mass wasting were identified during the field review (see soils section). The proposed harvest areas would be located so that they would be well-buffered from streams, springs and other bodies of water. SMZs would be identified and there would be no harvest within them. Equipment restrictions would be employed to preclude ground based equipment operations from occurring on steep slopes, draws or other ephemeral drainage features. All other applicable BMPs would be implemented for proposed harvest activities including timber harvest, site preparation, and slash disposal activities. Therefore, no impacts to water quality from erosion and sediment delivery are expected from these activities.

4.1.3 Alternative A: No Action, Cumulative Watershed Effects

Under the No Action Alternative, cumulative effects would remain the same as described in existing conditions. The effects would most likely decline over time as hydrologic recovery continues. Following the completion of the Ashby Creek Road Relocation Project, the long-term direct, indirect and cumulative risks of impacts to water quality will be greatly reduced from that occurring under the existing conditions.

4.1.4 Alternative B: Harvest, Cumulative Watershed Effects

There is a low risk of adverse impacts to channel stability and downstream beneficial uses in all 3 watershed analysis areas due to cumulative effects of water yield increases. The predicted incremental and cumulative increase in water yield following the proposed harvest is summarized in the table below.

Watershed Analysis Area	Incremental ECA from Proposal	Cumulative ECA	Incremental WYI	Cumulative WYI
Ashby Creek	171	2226	<1 %	13 %
Crammer Creek	135	1202	1 %	12 %
Unnamed Tributary	24	658	<1 %	14 %

There is a low risk of detrimental cumulative impacts due to increased water yields resulting from the Proposed Timber Harvest. The risks are low due to the following reasons:

1. The estimated levels of water yield increase following the proposed timber harvest are below the threshold levels set for each watershed.
2. There are no continuous stream channels draining the proposed harvest area. The Project Section is drained by discontinuous ephemeral drainage features with no direct surface water connectivity to down slope stream channels.
3. The proposed harvest prescriptions call for partial harvest with substantial residual canopy remaining following harvest. Therefore, the amount of incremental water yield increase expected to result from the proposed harvest is relatively low.
4. There is no evidence of existing stream channel impacts due to increase water yield. Most of the reaches of stream channel that are located immediately downstream of the Project Section and within the cumulative watershed analysis areas are relatively stable. The limited areas of channel instability that occur within the Project Area are isolated and localized. These minor segments of instability are attributed to site-specific conditions or factors such as concentrated cattle use, channelization due to road location, poor designed culvert installations, or mining tailings and waste.

5. Most of the previously harvested stands are well stocked with saplings and pole size timber. Potential water yield increases are expected to continue to steadily recover closer to a level that would be expected under fully forested conditions.

There is a moderate risk of low levels of cumulative impacts resulting from the proposed harvest activities due to increased sediment delivery to streams. Low level, short-term increases in sediment delivery are expected to result from maintenance activities and BMP upgrades to the existing access road. Increased sediment delivery is expected during and shortly after installation of BMP upgrades due to the close proximity of these activities to the stream channel. While these upgrades are expected to result in lower levels of sediment delivery than presently occurring, it's unlikely that the existing access road along the East Fork of Ashby Creek can be upgraded to fully meet BMPs. Therefore, a moderate risk of low-levels of sediment delivery would remain during use of the road for hauling activities.

4.2 Soils

4.2.1 Alternative A: No Action, Direct-Indirect and Cumulative Effects on Soils

Under the No Action Alternative: no timber harvest or road construction would occur within the Proposed Project Areas. No direct, indirect or cumulative effects to soil resource would occur under the No-Action Alternative.

4.2.2 Alternative B: Harvest, Direct and Indirect Effects on Soils

Direct and indirect effects to soil resources would be minimized by implementing BMPs and mitigation measures (see Chap.2.5.3). Soils at proposed road locations are well suited for forest road construction. The risk of erosion and slope instability would be low as long as BMPs applicable to new road construction and reconstruction are fully implemented. Rates of soil disturbance associated with the proposed timber harvest activities would be expected to be similar to those found on recently monitored DNRC harvest sites with similar soils and utilizing similar harvest prescriptions and yarding methods (DNRC 2009). Based on these monitoring results, soils disturbance within the Project Section is expected to result in less than 15% of the soils resource within the proposed harvest area being detrimentally impacted as a direct and indirect effect of the proposed harvest. Coarse woody debris retention would range between 5-12 tons/acre depending on habitat type. Overall soil productivity is not expected to be directly or indirectly affected.

4.2.3 Alternative B: Harvest, Cumulative effects to soils

The potential for cumulative effects to the soil resource is limited to that portion of the proposed harvest area that was previously harvested. The existing harvest area is limited in size and historic in nature. No detrimental soils disturbance was observed in previously harvest areas. Potential effects from previous harvest appear to have been ameliorated over time. Therefore the cumulative levels of

soil disturbance are expected to be similar to those estimated for the direct and indirect levels of soil disturbance. The cumulative detrimental levels of soil disturbance are expected to be below those recommended in the State Forest Land Management Plan (DNRC, 1996). Coarse and fine woody material would be retained as recommended by Graham et al. (1994). With woody debris retention met and mitigation measures effectively implemented, long-term soil productivity would be maintained. Considering all of the above, the proposed harvest activities pose a low risk for detrimental cumulative effects to soil resources.

4.3 Fisheries

4.3.1 Alternative A: No Action, Direct and Indirect Effects on Fisheries

The ongoing Ashby Creek Road Relocation Project will remove 3 poorly designed culvert stream crossing sites that are impacting fish populations and habitat connectivity because they are complete or partial barriers to fish passage at various flow levels. Two of these culvert crossings will be eliminated and one will be replaced with a bridge. These culvert removals are expected to improve fish passage and connectivity to the same level as provided in the natural stream system. The project will also move approximately 5000 feet of existing road that is located immediately adjacent to Ashby Creek to a location upslope and out of the floodplain. The project also includes several segments of stream channel restoration and construction of a 38 acre riparian grazing ex-closure. The removal of these culverts and relocation of the road is expected to greatly reduce several major long-term chronic sources of sediment delivery to Ashby Creek. While the new road location is considered low risk for sediment delivery, a moderate amount of short-term sediment delivery can be expected to occur during road obliteration, culvert removal and stream channel restoration activities. While short-term impacts to water quality are anticipated, they are expected to be relatively minor in magnitude and duration when compared to the ongoing, existing levels of direct and indirect sedimentation to the stream. The stream restoration and grazing ex-closure are expected to decrease sediment delivery and increase habitat complexity. Therefore, collectively these activities are considered low risk for detrimental impact to cold-water fisheries. Upon the completion of this project the long-term direct, indirect and cumulative risks of adverse impacts to fisheries and fisheries habitat will be greatly reduced and improved from that occurring under the existing conditions.

4.3.2 Alternative B: Harvest, Direct and Indirect Effects on Fisheries

The proposed timber harvest and proposed road construction activities are not expected to impact fisheries. These activities all have very low risks to fisheries because there are no fish bearing streams within the proposed harvest area. A proposed road would cross one stream segment (intermittent un-named tributary to Wallace Creek) that does not support fish. No harvest would occur within any SMZs.

The Action Alternative includes plans for extensive road maintenance and improvements to roads (BMP upgrades) along the Proposed Haul Route,

especially that segment of road located immediately adjacent to the East Fork of Ashby Creek. The Proposed Haul Route would also include use of the new segment of road relocated away from Ashby Creek. Use of this newly relocated road segment would include maintaining road drainage, erosion control and other BMP measures.

All applicable BMPs would be implemented during road maintenance and road improvement activities to minimize the potential for erosion and sediment delivery. The combined effects of both improvements to existing road segments that are part of the Proposed Haul Route and the Ashby Creek Road Relocation Project are expected to result in greatly decreased levels of long-term sediment delivery to both Ashby Creek and East Fork of Ashby Creek. However, low levels of short-term sediment delivery can be expected during and shortly after (one to two years) road maintenance/improvement activities occurring immediately adjacent to East Fork of Ashby Creek. In addition (even with all the Proposed Improvements to the existing road) it is unlikely that the 2.45 mile segment of existing road located immediately adjacent to the East Fork of Ashby Creek can be upgraded to fully meet BMPs. Therefore, there would be a moderate risk that the low levels of sediment delivery occurring during the proposed timber hauling activities would also likely persist. The continued levels of sediment delivery are consequently expected to continue to have low to moderate level impacts on fisheries and fish habitat in the East Fork Ashby Creek. These adverse impacts to fisheries and fish habitat resulting from continued sediment delivery to East Fork Ashby Creek include reduced quality of spawning habitat, reduced habitat complexity, increased peak seasonal stream temperatures and reduced invertebrate richness.

4.3.3 Alternative A: No Action, Cumulative Effects on Fisheries

The Ashby Creek Road Relocation Project has been implemented and is an independent action (not part of the Action Alternative). Long term the Ashby Creek Road Relocation Project (scheduled to be completed 2013) will reduce sediment delivery to Ashby Creek. The removal of three culverts and rehabilitation of the existing road being replaced will restore stream function and fish habitat long term.

4.3.4 Alternative B: Harvest, Cumulative Effects on Fisheries

While, risk of cumulative impacts due to increased sediment delivery risk would be greatly reduced from the current existing conditions, it is unlikely that risk would be reduced to a low level due to the proximity of the existing road to the East Fork of Ashby Creek. Therefore, a moderate risk of short-term low levels of sediment delivery from the existing road (portion of the Proposed Haul Route) would still occur as a result of the Action Alternative. The anticipated levels of sediment delivery are consequently expected to result in low to moderate risk of short-term low level cumulative effects on fisheries and fish habitat in the East Fork Ashby Creek. These adverse cumulative impacts include reduced quality of spawning habitat, reduced habitat complexity, increased peak seasonal stream temperatures and reduced invertebrate richness.

4.4 Weeds

4.4.1 Alternative A: No Action, Effects on Noxious Weeds

With No Action, noxious weeds will continue to spread along roads and may increase on the drier site habitats. Following disturbance events such as timber harvest activities, fires, or grazing, the establishment and spread of noxious weeds is more prevalent than in undisturbed areas. The DNRC would treat selected sites along open DNRC roads based on funding availability.

4.4.2 Alternative B: Harvest, Effects on Noxious Weeds

Implementation of the Action Alternative would involve ground-disturbing activities that have the potential to introduce or spread noxious weeds in susceptible habitat types. Should the Action Alternative be implemented, an Integrated Weed Management (IWM) approach would be employed for treatment of existing and prevention of potential noxious weeds. This would include prevention, re-vegetation and weed control measures for spot outbreaks, considered to be the most effective weed management treatments. Prevention measures would require cleaning of off-road equipment. Roadsides would be sprayed prior to operations and weed control and re-vegetation would reduce noxious weed density and occurrence compared to the No-Action Alternative. There would be similar or potentially a slight increase in weed infestation within proposed harvest areas due to soil disturbance and decreased tree canopy. Control efforts would promote re-vegetation and emphasize treatment of any new noxious weeds.

Herbicide application would be completed on segments of DNRC roads along the Proposed Haul Route, to reduce weed spread along roads and promote desired vegetation for weed competition and to reduce sedimentation. Herbicide would be applied according to label directions, laws and rules, and would be applied with adequate buffers to prevent herbicide runoff into streams. Implementation of IWM measures listed in the mitigations would reduce existing weeds, limit the possible spread of weeds, and improve current conditions, by promoting existing native vegetation. More weed control would occur compared to the No Action Alternative and grass and competitive vegetation would increase along roads.

4.5 Forest Vegetation

(Summary of effects of Action Alternative B: Harvest, see Chap.4.5.3.8).

4.5.1 Alternative A: No Action, Direct and Indirect Effects on Forest Vegetation

Under the No Action Alternative no harvesting of timber would take place. Mountain Pine beetle has killed 90% of sawlog size and ≥ 65% of smaller size lodgepole pine within the Project Section. As the majority of suitable host trees (brood trees) are dead, it is expected that the beetle having done its damage, must fly elsewhere to complete its life cycle. Salvage harvest of approximately 50-60 acres of lodgepole pine stands killed by Mountain pine beetle would not occur. Mature primarily Douglas-fir stands and some Western larch/ Douglas-fir stands with slow growth rates would remain much as they are now for the foreseeable future. Stand density would continue to increase slowly. Shade tolerant species

coverage would increase. Growth rates in these stands would be low as the trees continue to compete with each other for moisture and growing space. Tree mortality would continue as a result of competition, drought stress and subsequent insect attacks. Volume losses due to mortality and rot would continue. Shade intolerant species such as Western Larch and Ponderosa pine would decline over time due to competition and lack of any disturbance such as fire or changes to forest/ vegetative conditions. Without harvest trees with poor vigor would continue to die within the Project Section and become snags and subsequently increase down coarse-woody debris. Timber Stands would remain at risk to mixed severity and high severity (stand replacement) fire effects, with stands on northerly aspects (generally) at greater risk to the latter.

4.5.2 Alternative A- No Action, Cumulative Effects on Forest Vegetation

Slow growth rates and mortality within some stands would continue. Gaps created in overstory canopy would promote shade tolerant advanced regeneration. Over time these poorly fire resistant species would add to multistoried structure conditions, creating "fuel ladders" that would increase the risk for surface fires to spread into the crowns. Within some stands relative stand density would increase till stem exclusion would occur, resulting in mortality and increased down-woody debris. The combined effects of changes to species composition, structure and increasing fuel loading would all contribute to increasing the risk of severe fire effects, including stand replacement fire. The potential for cumulative impacts associated with the No Action Alternative with respect to forest vegetation and Natural Forest conditions is predicted to be negligible. The Project Section is less than one percent of the area comprising the Missoula Unit land base.

4.5.3 Alternative B: Harvest, Direct and Indirect Effects on Forest Vegetation:

Under the Action Alternative approximately 370 acres are proposed for harvest.

4.5.3.1 Insect and disease conditions (Harvest, Direct and Indirect Effects):

Incidental amounts of affected Lodgepole pine within road right-of ways and within limited portions of cable harvest units (yarding corridors) would be cut. The material is expected to have little to no commercial value at the earliest possible harvest time.

Douglas-fir Beetle: Harvest would via stocking reduction and sanitation/salvage treatments improve forest conditions with respect to insect and disease. Stocking controls and maintaining the most vigorous trees would improve stand vigor and make them more resistant to insect attack. For Douglas-fir stands stocking levels of 50-70 sq. ft. per acre of basal area is widely accepted as optimal for growth and yield, and health, especially with respect to resistance to insect attack (Douglas-fir Beetle). There may be a slight risk for increased mortality associated with maintaining these stocking levels and the subsequent susceptibility to attack from Douglas-fir Beetle. Negron, J.F and others (1999) found that

for Western Montana and Northern Idaho, in Douglas-fir stands of high-hazard conditions (age over 100 years, average diameter over 16" d.b.h, and high percentage of Douglas-fir in the stand), that mortality in Douglas-fir stands with a basal area of 115 sq. ft. per acre or less averaged 37 sq. ft. beetle-caused mortality, and could be defined as "low" risk (Negron et. al. 1999).

Rots: Generally the oldest trees (or age classes) will have the highest incidence of rot and this condition is evident within the Project Section. Thin barked species like subalpine fir and spruce would be more susceptible to damage from harvest operations and most trees of these species would be harvested. Harvest would remove some trees with rot including those with "un-seen" defects (rots). Trees that exhibit poor vigor, which is often indicative of rot, would be harvested. Trees (live or dead) with evidence of extensive rot (broken boles, conks and cavities and or ≥ 65% defect) would be retained (minimum 2 tpa). Harvest would damage some trees potentially making them more susceptible to some stem and butt rots (i.e. Fomitopsis officinalis, Phellinius pini and Phaeolus schwienitzii). Phaeolus schweinitzii root and butt rot does not spread via root to root contact; therefore partial cutting of Douglas-fir infected with P. schweinitzii would not increase its spread, unless retention trees are damaged during harvest operations. Harvesting some of the trees infected with P. schweinitzii would improve Douglas-fir stands by retaining trees exhibiting better than poor vigor. Post-harvest Douglas-fir stands so treated would be more resistant to attack from Douglas-fir beetle. P. schweinitzzi does kill roots and reduces root mass; therefore retention of some trees so affected could increase risk for trees to blow down post harvest. Retention of trees with best crowns available would favor trees with the greatest corresponding root mass and resistance to blow down. The Timber Sale Contract would include stipulations designed to protect trees retained (avoiding spring to early-summer harvesting, skid trail planning, directional falling required and fines for damaging retention trees). Promotion of more vigorous stand conditions (via Harvest) would improve overall growth and yield and to some extent offset losses due to rot (that is prevalent in trees ≥100 years old). Although not found within the Project Section, Armillaria ostoyae that may occur within the privately owned Section 21to the south, could spread more rapidly post harvest. Fresh stumps created during harvest could provide suitable sites for A. ostoyae to grow and subsequently infect through root contact to adjacent Douglas-fir trees, thus increasing its rate of spread into the Project Section, when compared to the No-Harvest Alternative. As mitigation, the harvest would not occur immediately adjacent (within ≥100 feet) to the common boundary of the Project Section 16 and 21where A. ostoyae is thought to occur at its nearest point; east (and south) of the ¼ corner of the Sections. Additionally retaining the most vigorous trees would promote disease resistance. The existing road along the north side of the aforementioned harvest area would prevent root to root contact and spread

north of the road, assuming no stumps north of the road would be infected post harvest. However, even without harvest A. ostoyae could eventually spread within the Project Section. There are no practical means or methods to prevent the spread of A. ostoyae. Long term management including planting of a more resistant species such as Ponderosa pine would be indicated for areas that could be affected by A. ostoyae.

4.5.3.2 Stand Structure (Harvest, Direct and Indirect Effects):

The proposed harvest would maintain the multi-storied stand structures which are currently predominant within the Project Section and would maintain all size trees and promote development of younger age class trees and a new age class of trees (on a small percent of area, 10-20%). The proposed intermediate cuttings within the proposed harvest areas would not change the structure type for these stands. Cutting within the multi-storied structures, that would be low thinned and crown thinned would decrease the number of trees within the intermediate and co-dominant crown positions. Multistoried and/or heterogeneous stand structure classification would not likely change however, because all size class trees would be represented post-harvest. Shade tolerant species coverage would be reduced greatly within intermediate and co-dominant crown positions. Shade intolerant species (i.e. Douglas-fir and especially Western larch would be maintained within aforementioned crown positions and as well as dominants. The proposed harvest would likely not change the stand structure classifications.

4.5.3.3 Stand Stocking Levels (Harvest, Direct and Indirect Effects):

SLI estimates of the total crown cover density for timber stands within the Project Section are 43% Medium stocked and 57% well stocked. Poor crown cover is 10-39% crown cover; Medium crown cover is 40-69% crown cover and Well is 70-100% crown cover (CC) density. The proposed harvest areas are in a Medium or Well-stocked condition (total crown cover density, 46% and 54% of the area respectively).

The proposed harvest would greatly reduce stocking of sawtimber and reduce sub-merchantable tree stocking (on up to approximately14-20% of the area, skidding corridors). Post harvest sawtimber stocking condition would range from Poor to Medium. It is estimated that approximately 50-65% of the gross board foot volume would be harvested (within areas proposed for harvest).

Stocking of proposed harvest areas would be reduced from on average approximately 160 square feet of basal area per acre to 40-60 sq. ft. of basal area. Within proposed harvest areas approximately 30-40% of crown cover (CC) would be maintained. Within areas receiving a salvage treatment, dead and insect infested trees would be harvested and crown cover would likely be reduced to the lower end of the range of 30-40% crown cover. It is estimated that the weighted average diameter for trees

within the proposed harvest area (that are merchantable ≥ 7"dbh) is 14.5" diameter "breast" height (dbh) approximately and there are approximately 107 trees per acre (tpa). It is estimated that the average diameter for trees that would be retained within harvested areas is 18.6" dbh. It is estimated that 13tpa ≥ 17" dbh and 8 tpa ≥ 21"dbh (approximately half of available) would be retained within areas proposed for harvest.

Within Lynx Habitat ≥ 40% crown cover would be maintained. The proposed harvest would affect 230 acres of Lynx Habitat and accounts for 62% of the area proposed for harvest (see Table 4.5-1 below). This would include maintaining available crown cover for both merchantable and sub-merchantable trees. In addition to sub-merchantable CC maintained it is estimated that approximately 40-70 sq. ft. of basal area would be retained in order to maintain 40% CC. Within portions of Proposed Harvest Areas advanced regeneration composed of shade tolerant species (sub-alpine fir and spruce saplings) would be retained along with intolerant species.

Table 4.5-1: Proposed Harvest

Type of Lynx Habitat:	Acres	% of Harvest Area
Other Suitable	**25**	7
Summer Foraging	**1**	~0
Winter Foraging	**204**	55
SUM: Total Lynx Habitat Harvested	**230**	62
Not Lynx Habitat	140	38
SUM: Total Proposed Harvest:	370	100

For proposed harvest areas that are currently Well stocked (70-100% CC) and within Lynx habitat potentially 30-60% of the cover would be available for harvest. If the stand had 160 square feet of basal area then approximately 64 sq. ft. of basal area would need to be retained to provide Suitable cover for Lynx.

Considerations for maximizing CC within Lynx Habitat: Retention tree selection would favor trees expressing: dominance, best available health, vigor, and form including well developed crowns. In practice selecting retention trees with well-developed crowns would represent the largest diameter trees for a given age class.

There are formulas available that estimate that for Douglas-fir stands with 40 % CC that the basal area would range from 50-60 sq.ft. Dealy's research suggests basal areas as low as 25 sq. ft. may provide canopy closures of 40%. His work also suggests that BA's of 50 sq. ft. provide canopy closures of between 55% and 65% (Dealy, J.E. 1985). However, given his caution regarding thinned stands, it is recommended that basal areas of 50 to 60 sq. ft., be retained to provide 40% canopy cover.

4.5.3.4 Current Cover Type Condition (Harvest, Direct and Indirect Effects):

Under the Action Alternative approximately 370 acres are proposed for harvest.

Table 4.5-2 shows acres and percent of proposed harvest area of Current Cover Types that would be affected by the proposed harvest. The proposed harvest would affect 58% of the Project Area.

Table 4.5-2: Current Cover Types of Proposed Harvest		
Cover Type	Acres	% of Harvested Area
Douglas-fir (DF)	275	74.3
Lodgepole pine (LPP)	8	2.2
Sub-Alpine fir (SAF)	71	19.2
Western larch/ DF (WL/DF)	16	4.3
Totals:	**370**	100.0

4.5.3.4.1 Project Area DFC (Harvest, Direct and Indirect Effects):

There are limited opportunities to shift the cover type representation within the Project Section and subsequently on Missoula Unit (see Table 4.5-3). Approximately 187 acres within the Project Section are not in an Appropriate Cover Type condition as indicated by the SLI model. Most notably there are currently 109 acres too many in the Sub-alpine fir Cover Type and 78 acres too many in the Douglas-fir Cover Type.

Table 4.5-3: Project Section Cover Type Condition where Current Cover is not equal to DFC. Potential to shift Current Cover to DFC.		
Current Cover Type	DFC	Acres
Subalpine fir	Western larch/ Douglas-fir	82
Subalpine fir	Douglas-fir	27
Douglas-fir	Western larch/ Douglas-fir	65
Douglas-fir	Lodgepole pine	13
Total acres that potentially could be shifted towards DFC:		**187**

Table 4.5-4 shows the Current Cover Type condition for the proposed harvest area where Current Cover is not equal to the DFC.

Table 4.5-4: Proposed Harvest Area Cover Types where Current Cover is not equal to DFC			
Current Cover Type	**DFC Cover Type**	**Acres**	**%**
Douglas-fir (DF)	Western larch/ Douglas-fir (WL/DF)	39	32.2
Douglas-fir	Lodgepole pine (LPP)	9	7.4
Subalpine fir (SAF)	Western larch/ Douglas-fir	70	58.0
Subalpine fir	Douglas-fir	3	2.4
Total acres that potentially could be shifted towards DFC via harvest		**121**	**100**

Table 4.5-3 shows that within the Project Section there are Currently 187 acres that are not in the Appropriate Cover Type condition or DFC. Table 4.5-4 shows that there are 121 acres where the Current Cover Condition is not equal to the DFC that would be affected by the Proposed Harvest.

Table 4.5-5: Project Section Cover Type Shift Groups (Current Cover to DFC): **Potential** shift via Harvest

Cover Type Shift Group Current Cover to DFC	Acres	Proposed Harvest Acres	Acres and % area **not** shifted via Harvest		% Area Affected by Harvest (potential)
SAF to WL/DF	82	70	12	15%	85%
SAF to DF	27	3	24	89%	11%
DF to WL/DF	65	39	26	40%	60%
DF to LPP	13	9	4	31%	69%
Totals:	187	121	66	35%	65% potential shift

Table 4.5-5 summarizes data from Tables: 4.5-3 and 4.5-4 and shows to what extent the Project Section Cover Type Condition potentially could be shifted by the proposed harvest. Limitations as follows:

1. The proposed harvest would not harvest all acres within the Project Section.
2. Treatments within harvested areas may not necessarily achieve the DFC, by not adequately altering species coverage's.

At most the proposed harvest potentially could shift 65% of the area for Cover Types that are currently not equal to the DFC, towards the DFC. In actuality whereas the proposed harvest may trend affected areas towards the DFC, it may not adequately alter species coverage to the extent that the Cover Type Classification would change. Cover Type shifts (post-harvest achievement of DFC within the Project Section as shown in Chapter 3.5, Table3-1) would likely not occur for the following reasons:

- All stands where Current Cover differs from DFC are within Lynx Habitat.
- Maintaining 40% Crown Cover within Lynx Habitat (62% of proposed harvest area, see Table 4.5-1) would take precedence over potential cover type shifts.
- Maintaining and protecting sub-merchantable trees including shade tolerant species within Lynx Habitat.
- Some stands lack sufficient Western larch (WL) coverage; other than those Currently WL/DF. That is some stands that are Appropriately WL/DF (Currently SAF, even if all the merchantable Subalpine fir were harvested), may lack sufficient (≥10% CC) Western larch coverage, to become WL/DF post-harvest. Post-harvest these would probably be classed DF Cover Type. Note: it is expected that most stands that are Appropriately DF (Currently SAF) would be classed DF Cover Type post-harvest.

- Whereas the majority of overstory (merchantable trees) retained would be Douglas-fir and Western larch respectively, the understory (sub-merchantable trees) cover maintained would consist of Douglas-fir, Subalpine fir and some spruce.
- For a 13 acre stand (far West ridge top location, aspect N and SW) that is Appropriately Lodgepole pine (Currently DF), both maintaining: 40% CC for Lynx and optimal stocking of DF for growth and yield would take precedence. The majority of Subalpine fir would be harvested where it occurs on a 1/3 of the area. The majority of Lodgepole pine is dead or dying. Note: all other stands occur on Northerly aspects.

Summary: Project Area DFC (Harvest, Direct and Indirect Effects): The post-harvest achievement of DFC within the Project Section is shown in Chapter 3.5, Table 3-1. Maintaining 40% Crown Cover within Lynx Habitat would take precedence over potential cover type shifts. Where Current Cover is not equal to DFC within the Project Section, 79% (147 acres) is Appropriately WL/DF Cover Type. Harvest would affect 90% (109 acres) of these stands that are Appropriately WL/DF. There is currently insufficient Western Larch coverage within the Proposed Harvest Area to effectively achieve the DFC within the Project Section post-harvest, as Modeled. Of this Table 3-2 showed only 10 acres DF Cover Type Currently that would be WL/DF post-harvest. The proposed harvest would trend these Appropriately WL/DF stands towards the DFC, but would not substantially alter their Cover Type Condition. This is because it is estimated that there would not be ≥10% cover of Western larch post-harvest within these affected areas. The proposed harvest would reduce subalpine fir coverage sufficiently on 73 acres of the 109 acres Currently SAF, to shift coverage to the DF Cover Type on 63 acres and to the WL/DF Cover Type on 10 acres. Whereas Western larch coverage may increase post-harvest and over time, it would be limited by seed source, site preparation, and competition from other species coverage including advanced regeneration, partially a result of maintaining 40% CC within Lynx Habitats.

4.5.3.4.2 Missoula Unit DFC (Harvest, Direct and Indirect Effects):

The Proposed Harvest Area represents less than ½% of Missoula Unit's affected area. The proposed harvest would have a negligible effect on altering the Cover Type Condition on Missoula Unit.

4.5.3.5 Age Class Distributions (Harvest, Direct and Indirect Effects):

Table 4.5-6: Age Classes affected by Proposed Harvest (% Area)			
40-99	**100-150**	**150+**	***Potentially* Old Growth (*SLI Model estimate*)**
6%	**10%**	**80%**	**4%**

Table 4.5-6 (same as table 3-6) shows to what extent Project Area Age Classes would be affected by the proposed harvest as a percentage of the Proposed Harvest Area. Herein, "Old" (Stands or trees) will be defined as ≥ 150 years old. Approximately 84% of the proposed harvest would occur in Old Stands (which occupy 81% of the Project Area, as shown in Table 3-4).

The proposed harvest would remove trees from all size and age classes. The average diameter for trees ≥7" dbh within the proposed harvest area is 14.6" dbh. It is estimated that the proportional amount of trees harvested would be approximately: 65% ≤ 15" dbh and 75% ≤ 17" dbh. Trees retained would include approximately: 13 tpa ≥17' dbh, of which a minimum of 8 tpa would be ≥ 21" dbh (representing half of available trees ≥21" dbh). Trees retained would average 18.6" dbh.

The majority of the trees (≤ 15" dbh) that would be harvested are estimated to be ≤ 150 years old.

The proposed harvest would decrease the number of Old trees within harvested areas; however it would increase the proportional amount of Old trees. This would be the result of harvesting 65% of trees estimated to be ≤ 150 years and ≤ 15" dbh. It is estimated that post harvest stand age would increase slightly; however not to the degree that it would effectively change the SLI Age Class. As such the proposed harvest is not expected to immediately alter the Age Class distribution within the Project Area, nor Missoula Unit.

Conclusions: The proposed intermediate cuttings within the proposed harvest areas would not change the age class for these stands, un-even aged stands would remain so. Cutting within the multi-storied structures, if they were low thinned would increase the average stand age (however this may not necessarily change the age class). The age class for multistoried or heterogeneous structures would not likely change if individuals of all ages were harvested, although the average stand age could increase slightly as a result of harvesting a greater proportion of trees from within younger age classes. This would be especially true for harvest within potential Old Growth stands. The variance of ages and age distribution within stands would decrease shifting the distribution within harvested areas slightly older. However the proposed harvest would likely not change the age class nor age distribution but rather would trend age classes toward what was typical historically.

4.5.3.6 Potential Old Growth (Harvest, Direct and Indirect Effects):

Stands classed as ≥150 years within the Project Area were stratified and sampled as per SLI protocol (2008-2011). This survey estimated that within the Project Area there is approximately 230 acres of Potential Old Growth. The proposed harvest would affect 160 acres representing 43% of the proposed harvest area. Potential Old Growth refers to stands that are Old and estimated to satisfy one of the following conditions:

1. Currently meet Green et al Old Growth Criteria.
2. Have a high probability of meeting Green et al Old Growth Criteria.
3. Would or could soon (within 10-20 years) meet Old Growth Criteria
4. Have sufficient good quality large diameter trees with better than poor vigor.

Within proposed harvest areas that are potentially Old Growth requisite numbers of large diameter trees would be retained regardless of age. The DNRC has adopted the Green et al definition of Old Growth (ARM 36.11.403). As per SLI protocols assignments are made to determine minimum Green et al criteria (Old Growth Type Class) for each stand based on Habitat Type (Forest Habitat Types of Montana, Pfister et al) and Current Cover Type. For the Habitat Types and Cover Types (DF and WL/DF) within the Project Section, there are three Old Growth Types (as defined by Green et al), minimum requirements as follows:

1. 8 tpa ≥ 21" ≥ 170 years.
2. 10 tpa ≥ 21" ≥ 180 years.
3. 10 tpa ≥ 17" ≥ 180 years.

The proposed harvest would maintain sufficient numbers of large diameter trees within areas that are potentially Old Growth to satisfy the large diameter tree requirement (per relevant Old Growth Type) as specified above.
In practice meeting the age criteria with respect to some large diameter trees retained, and post- harvest stand age would be disregarded, to the extent and consequence, that some Old trees exhibiting poor vigor are proposed for harvest. Large diameter tree retention preference (as well as for all trees) would prioritize some of the following characteristics:

1. Western larch preferred over Douglas-fir.
2. Trees exhibiting better than poor vigor.
3. Trees with well developed crowns.
4. Trees expressing dominance.
5. Trees with good form, free of insect, disease and major defect (trees with ≥65% defect due to rot would be retained).

Selection of large diameter retention trees (within stands that are potentially Old Growth) would consider age less important than the aforementioned criteria for retention trees. Thus there is a chance that younger trees, not necessarily the oldest trees, would be retained.
It is estimated that approximately 8 tpa ≥ 21" dbh and 13 tpa ≥17" dbh would be retained within proposed harvest areas. Approximately half of

the available trees that are ≥21" dbh would be retained within proposed harvest areas. Large diameter trees ≥17" dbh retained within potential Old Growth stands would account for approximately (minimum) 16-24 square feet of basal area. The basal area: for a 17" dbh tree is approximately 1.576 sq. ft.; and for a 21"dbh tree approximately 2.4 sq. ft.
The proposed harvest would reduce the number of Old trees within affected areas. There is a moderate risk that that the proposed harvest would reduce the current amount of Old Growth including attributes associated with Old Growth (numbers of Old large diameter trees, snags and coarse-woody debris), within the Project Area. Within harvested areas the variance of ages and distribution thereof within old stands would decrease (or narrow) shifting the distribution within harvested areas slightly older. The proposed harvest would improve overall stand vigor, decrease the incidence of insect and disease; and reduce the risk of high severity fire effects within 1-5 years post-harvest.

4.5.3.7 Emulating Fire (Harvest, Direct and Indirect Effects):

The proposed harvest boundaries would closely follow patterns created by past fires. Proposed maintenance treatments within potentially Old Growth stands for the Old Growth Types represented within the Project Section are consistent with ARM 36-11-418. These maintenance treatments are applicable to forest types that typically experienced mixed severity fire effects. Most fire resistant Western larch and very resistant: Ponderosa pine and Douglas-fir would be maintained within all areas harvested (where these species occur). Retention of Western larch especially would be a high priority: being the most fire resistant species (most likely to survive fire) and its cover is limited currently where more cover should be on northerly aspects of the Project Section (Fire Groups 8 and 9). These stands on the northerly aspects are all classified as Lynx Habitat. Retention of shade tolerant species, primarily sub-merchantable subalpine fir which is the least resistant to fire, within Lynx Habitat, would to some extent be a departure of what would be expected should a fire occur. That is, it would be most likely that the majority of subalpine fir and spruce would be killed by fire, even though some patches could be expected to survive under less severe fire effects. However the majority of merchantable shade tolerant (least fire resistant) trees would be harvested so to that extent harvest treatment would emulate mixed fire effects. It is not un-common on these Northern more mesic aspects for non-lethal fires to occur, within Fire Group 8 (as defined by Fischer and Bradley), thus encouraging shade tolerant species to perpetuate, that is, stands to develop towards climax conditions. The greatest departure would be more from a silvicultural perspective, where fire would prepare seed beds and reduce competition from shade intolerant advanced regeneration, to promote Western larch regeneration. Encouraging shade tolerant species is a departure from Desired Future Conditions as prescribed in ARM for Forest Management. However, the fine filter

analysis directed management goals to favor critical forest attributes associated with forested stands classified as Lynx Habitat.
Fire Group 6 stands (75%) are predominant on southerly aspects within the Project Section. Fire's role, within Fire Group 6, in preparing seed beds and establishing regeneration is less critical. The proposed harvest would reduce stocking within these primarily Douglas-fir stands to levels that more typify the fire maintained open forest conditions that were typical prior to Euro-American settlement (Fischer and Bradley 1987). The harvest would emulate the effects of the mixed severity fires which were common within Fire Group 6 (as defined by Fischer and Bradley 1987) and as prescribed in ARM for Forest Management (36-11-418).

Forest fuel treatments for the Action Alternative B: Harvest:
A portion of the logging slash would be retained or returned within harvest areas for nutrient retention. It is estimated that of the slash generated from the proposed harvest activities: approximately 25-35% would be concentrated at landings and the majority of slash cleared from within newly constructed road R-O-W's would be burned.
It is proposed that approximately 5-10 tons per acre of coarse woody debris (>3" in diameter) and including finer fuels (< 3'' diameter, limbs and foliage) would be retained or returned within harvested areas. Total accumulations of up to approximately 30 tons per acre, would be possible in some areas.
Fire hazard reduction: Slash retained (or returned) for nutrient cycling would be kept away from leave trees to the greatest extent possible. Fuel breaks would be employed along property boundaries, harvest unit boundaries, roads and along ridge tops. Removal of pulp, small round wood and cull sawlog material (although optional) would reduce fuel load. The Timber Sale Contract would stipulate that slash would be lopped and or trampled to within 18" or less of the ground. Slash would dry for approximately one year, after which the DNRC would assess the need and benefit of burning any portion of the slash within harvested areas. Excessive amounts of slash, accumulations at landings and along roads, that were not scattered, would be piled and burned.
Risk of fire: Logging slash retained or returned to within harvest areas would increase the risk of effects from wildfire short term (1-3 years approximately). High fine fuel retention could be problematic (potentially increasing the rate of fire spread) with respect to fire control when compared to whole tree harvest and burning the majority of slash generated and accumulated at landing sites. Increased coarse woody debris retention could increase potential wildfire intensity and resistance to suppression.
Mitigating risk of fire: Trampling, scattering and lopping slash within 18" of the ground surface is intended to minimize flame lengths to 4' or less should a fire ignite. Planned fuel breaks along property boundaries, either side of roads and along ridge tops would help contain a fire should

one occur. Slash piles would be burned in the fall when they are relatively dry inside but the layer of duff on the forest floor surrounding the piles is wet or snow covered to prevent fire spread.

Fire Effects: If a fire were to occur during hot and dry conditions, resultant ground and surface fires would damage tree: roots, root collars and boles (cambium damage). For some areas affected by fire, fire would kill most seedlings and saplings, many pole size and some larger diameter trees, potentially resulting in low to mixed severity fire effects. A wind driven fire when conditions are hot and dry could result in mixed to high severity fire effects, where a portion of the affected area could experience stand replacement fire effects. The most fire resistant species such as Western larch and Ponderosa pine, especially large diameter trees would be favored.

Proposed modified shelter-wood harvest treatments would: retain large diameter Western Larch, trace amounts of Ponderosa pine and Douglas-fir, create openings and reduce tree stocking densities to a level that would be more resistant to crown fire, through harvest of shade tolerant species (including ladder fuels) that are the least fire resistant, especially when compared to current forest stand conditions.

4.5.3.8 Summary of Harvest: Alternative B, Direct and Indirect Effects to Forest Vegetation:

The Proposed Harvest would:

1. Not alter the Age Class Distribution within the Project Section nor on Missoula Unit.
2. Modify forest cover within the Project Section to what was more typical of Historic conditions.
3. Trend stands within the Project Section towards the DFC through shifts in species coverage (increasing the proportion of shade intolerant species relative to shade tolerant species).
4. Have a low potential to reduce the amount of mature forest cover <u>any further</u> below what Losensky reported when compared to forest cover on Missoula Unit.
5. Pose a moderate risk to decreasing the amount of Old Growth within the Project Section, as a result of harvesting some Old trees exhibiting poor vigor.
6. Impact the quality of mature forests within the Project Section, with respect to abundance of: shade tolerant tree species, snags, large diameter trees and coarse-woody debris.

4.5.4 Alternative B: Harvest, Cumulative Effects on Forest Vegetation

The proposed harvest would account for approximately less than half of one percent of the total acreage comprising Missoula Unit. Thus any potential impacts or modifications to forests (and attributes thereof) within the Project Section, when compared at the scale to which Missoula Unit's forested lands would be correspondingly affected, would be relatively negligible.

On DNRC forested lands covered by the HCP, Lynx Habitat Suitability would be monitored and accounted for (by the DNRC) in order to maintain a condition where 65% of Lynx Habitat would be maintained in a "Suitable" condition. If, as a direct result of the proposed timber harvest some Lynx Habitat where to become "Temporarily Un-Suitable", cumulative impacts would be considered (accounted for) with respect to impacts that may result from future modifications to Lynx Habitat on Missoula Unit that constitute a portion of the lands administered by the South Western Land Office. Currently there is an excess of Suitable Lynx Habitat (greater than 65%) on Missoula Unit.

There is a moderate risk that the proposed harvest would reduce the quantity of Old Growth within the Project Section, as a direct result of harvesting some Old trees exhibiting poor vigor. There is the potential (or cumulative risk), that continued harvest within Old stands on Missoula Unit (and or the effects of wild fire or any other disturbance, such as insect mortality) would:

1. Contribute to the reduction of both Old Growth and Old Stands further below what Losensky reported.
2. Postpone the condition when, the Age Class Distribution on Missoula Unit approximates the Historic Age Class Distributions as reported by Losensky.

4.6 Air Quality

4.6.1 Alternative A: No Action, Effects to Air Quality

Wildfires would continue as a threat to forested areas. If a wildfire were to start within the Project Section the rate of spread and the intensity of the fire could be high due to the dense stocking of trees and multi-storied structures with the presence of ladder fuel on the site. The potential for stand replacement crown fire exists. In the event of wildfire, air quality would be affected. There would be no logging slash generated.

4.6.2 Alternative B: Harvest, Direct and Indirect Effects to Air Quality:

Forest fuel treatments:

A portion of the logging slash would be retained or returned within harvest areas for nutrient retention (Timber Sale Contract stipulation). It is estimated that of the slash generated from the proposed harvest activities: approximately 25-35% would be concentrated at landings and the majority of slash cleared from within newly constructed road R-O-W's would be burned. This treatment compared to

whole tree harvest (where the majority of slash generated would be piled at landings and burned) would have the potential to generate much less smoke.

Smoke management:

With proper smoke management applied, impacts to air quality should be minor and short in duration. Burning would likely begin sometime in October and would need to be concluded by November 30. The Project Section is in the 3A Air Shed and is immediately east and along the boundary of the Missoula Impact Zone (SW corner of the Project Section is a point common to the Impact Zone Boundary). Burning of slash piles would be conducted under conditions of: good dispersion and westerly winds. The community of Clinton including residents within the Wallace Creek drainage immediately to the west could be impacted by smoke if an east wind or high pressure weather system (subsequent cold air inversion) was to develop post-ignition. Similarly the Potomac valley community immediately north of the proposed burning could be affected should an air inversion or southerly wind develop post-ignition. Residents nearest the Project Section (NW of, West Fork of Ashby Creek, T12N, R16W), located within the approximate center of Section 8 could be affected by both smoke and dust resulting from harvest operations. However they are more than ½ mile distant to the nearest proposed road and they are generally up-wind relative to prevailing westerly winds. They too could be impacted by southerly winds and inversions post-ignition. To the south of the Project Section there are residents in the Cramer Creek drainage and smoke could drift down the West Fork of Cramer Creek due to a cold air inversion or north wind. Thus there is the potential for short term impacts to air quality within any of these communities worst case scenario. This notwithstanding, direct and indirect effects to air quality from burning slash should be relatively minor and of short duration.

Dust generated during harvest operations: Harvesting and log hauling could create dust which may also affect the air quality within the Project Area and along the haul route. West Fork of Ashby Creek residents (Section 8, not immediately adjacent to the Proposed Haul Route) could be affected by (both smoke and) dust resulting from harvest operations. However both the fact that their location more than ½ mile distant to the closest proposed road and that they are generally up-wind relative to prevailing westerly winds, should lessen the possibility of impacts. Any potential impacts from dust created within the Project Section from harvest operations would likely be negligible (well dispersed). The Timber Sale Contract period would be three years. Transportation of forest products (hauling), road maintenance, re-construction of road segments and construction activities would be on-going within this tree year period. It is estimated that approximately 820 loads of logs would be hauled within the three year period. The majority of hauling would likely occur during the last two years of the Contract period. Final road maintenance activities would occur after hauling is completed. Haul rates are expected to fluctuate. Whereas production rates of 5 loads per day could be expected, it is estimated that the rate could peak at approximately 10 loads per day at times. Although not expressly limited, hauling would likely take place on week days (20 days per month). Thus the hauling period could range from 4- 8 months. Whereas traffic could be highly variable, potential impacts resulting

from increased traffic would occur for a relatively short duration thereby minimizing dust dispersal within the local residential areas. Additionally, Missoula County performs dust abatement on the first 2.3 miles (Morrison Lane) of the Proposed Haul Route, thus effects to local residents that reside adjacent to the Proposed Haul Route are expected to be minimal. Thus direct and indirect effects to air quality resulting from dust due to hauling forest products are expected to be minimal and relatively short in duration.

4.6.3 Alternative B: Harvest, Cumulative Effects to Air Quality

Smoke resulting from the burning of slash may have a cumulative effect with other prescribed burns being conducted in the region as well as with pollutants produced from other sources. Smoke produced in Montana and Idaho is regulated by the smoke monitoring unit, and its cumulative impact is considered in issuing burning restrictions. (Turah Creek EA, DNRC 2002).

4.7 Recreation

4.7.1 Alternative A: No Action, effects to recreation

No change would occur.

4.7.2 Alternative B: Harvest, direct, indirect and cumulative effects to Recreation

The proposed timber harvest would not alter the current road restrictions that prohibit motorized public road use. Forest products would not be hauled on any designated snowmobile routes within the Garnet Winter Recreation Area managed by the BLM. Recreational activities within the Project Area could be affected by harvest activities during the Timber Sale Contract period up to three years. Slash burning would occur one year following completion of harvest activities in the fall and burning operations could affect area users' short term, one week approximately.

4.8 Economics

4.8.1 Alternative A: No Action, Economic effects

Under Alternative A: No Action, no harvesting would take place and no revenue would be generated with the exception of proceeds from Recreational Use Licenses and a grazing lease.

4.8.2 Alternative B: Harvest, Economic Effects

Approximately $100,000-$150,000 would be generated for the Common Schools Grant from the proposed harvest and sale of the estimated 14,000-21,000 tons. The amount of forest improvement (FI) collection from this sale (at current FI rate of collection) would be approximately $3.24 per ton. This would be applied to the sawlog tonnage harvested (weighed at certified scale). It is estimated that the total FI collection would be approximately $45,360-$68,040. This money would

be deposited in the forest improvement fund to be used for thinning, prescribed burning, planting, weed management, etc. on Trust Lands.
The proposed project if implemented would provide work for a road building contractor, a logging contractor, their subcontractors, and their employees. The forest products would most likely be processed in local mills providing further job opportunities.

4.9 Visual Quality

4.9.1 Alternative A: No Action, Effects to Visual Quality

Under Alternative A: No Action, no road building or harvesting would take place. There would be no immediate change to visual quality. The abrupt edges of the Project Section would not be modified. Predominantly immature trees (sub-merchantable trees: pole size and saplings) within areas surrounding the Project Section would continue to grow and there would be an increase in crown density. The increase of crown density would provide greater snow intercept. Currently, the difference in snow intercept between cut and un-cut areas; makes cut areas more visible from afar while there is snow on the ground. As a result, the cut areas appear light (a shade of white) and the un-cut areas appear darker in contrast when there is not snow accumulated in the crowns of trees in the un-cut areas. As the trees within the cut areas increase in size and crown density there will be a corresponding decrease in contrast between previously cut and un-cut areas. Within the Project Section individuals and groups of trees eventually would die providing gaps in the tree canopy; which would provide changes to the contrast between the Project Section and previously harvest areas surrounding the Project Section. Long term changes to both the cut and un-cut areas would likely improve the visual quality of the Project Area when viewed from afar.
In the event of a forest fire, assessing effects with respect to visual quality would be subjective and difficult to predict with any certainty. However there is the potential for stand replacement and mixed severity fire to occur within the Project Area. Should a fire occur there would be an active effort to suppress the fire, where by consideration of effects to visual aspects would likely be subordinate. These types of changes to forest cover, particularly a stand replacing fire could have a very noticeable impact on visual quality at some point in the future. However even without some type of disturbance, such as fire, timber harvest, wind damage or insect epidemic, far view visual quality would likely improve progressively over time. Even though alterations to landscape patterns that resulted from cutting up to the boundaries of the Project Section would remain, if not altered, they would be less conspicuous over time.

4.9.2 Alternative B: Harvest, Direct, Indirect, and Cumulative Effects to Visual Quality

Proposed harvest and roads would affect the visible landscape, including the distant view of the Project Area from Potomac Valley locations. Approximately 5 miles of new road would be constructed within the Project Area (all but approximately 750’ within the Project Section). The proposed Lower North slope

road (see figure 2-1) would be mostly hidden because of its low elevation and acute angle formed when viewed from afar (vicinity of Potomac). The proposed Upper road on the North Slope would be partially visible, even though the road would be partially screened by un-harvested areas above and below the road. Additionally rolling the road grade would make the road less noticeable than if it was constructed with a sustained grade.

The proposed shelterwood treatments would tend to improve visual quality. The combined result of reducing stocking and creating openings within proposed harvest areas, especially along the boundaries of the Project Section, would diminish noticeable edges and decrease contrast. This would improve the scale of cutting patterns when viewed from afar and would tend to make them appear more natural. Approximately 230 acres or approximately 62% of the Harvest Proposed would occur within areas classed as Lynx habitat. Within Lynx Habitat 40% crown closure would be maintained. The potential to reduce stocking and create openings within Lynx habitat would be restricted (by maintaining 40% crown closure); and as a result would decrease opportunities for mitigating impacts to visual quality when viewed from afar. Although subjective, retaining 40% crown cover would not diminish aesthetics when viewed from within the Project Section.

4.10 Wildlife: Effects of Alternatives:

4.10.1 Mature Forested Habitats and Landscape Connectivity

4.10.1.1 Alternative A: No Action, Direct and Indirect Effects to Mature Forested Habitats and Landscape Connectivity

Forests would continue to age, and denser stands of shade-tolerant tree species with increasing canopy cover would gradually develop. No appreciable changes to forest age, the distribution of dense forested cover, or landscape connectivity would be anticipated in the short-term. No changes in wildlife use would be expected. Existing habitats for forested interior species and old-stand-associated species, such as American marten, northern goshawk, and pileated woodpecker, would likely persist under this alternative; however, western larch and ponderosa pine, which are preferred snag species, could decline in abundance over time. Thus, no risk of direct or indirect effects to mature forested habitats and connectivity would be expected since:

1. No changes to existing stands would occur.
2. No appreciable changes to forest age, the distribution of dense forested cover, or landscape connectivity would be anticipated.
3. No changes to wildlife use would be expected.

4.10.1.2 Alternative A: No-Action, Cumulative Effects to Mature Forested Habitats and Landscape Connectivity

Mature forested habitats are somewhat limited in the cumulative effects analysis area due to past harvesting. Those stands presently contributing to the mature forested stands in the cumulative-effects analysis area would not be altered. Continued use of the analysis area by species favoring dense stands of shade-tolerant tree species, and those species requiring larger areas of mature forests, would be expected at similar levels to the present. Any use by forested-interior wildlife species and old-stand-associated wildlife species, such as the American marten, northern goshawk, and pileated woodpecker, would likely continue at relatively similar levels to the present. Thus, no risk of cumulative effects to mature forested habitats and connectivity would be expected since:

1. No changes to existing stands would occur.
2. No further changes to forest age, the distribution of dense forested cover, or landscape connectivity would be anticipated.
3. No changes to wildlife use would be expected.

4.10.1.3 Alternative B: Harvest, Direct and Indirect Effects to Mature Forested Habitats and Landscape Connectivity

Approximately 370 acres of Douglas-fir, Douglas-fir/western larch, western larch, and mixed conifers would be harvested, including roughly 352 acres of mature stands with a closed canopy. Approximately 51acres of mature forested habitats would receive a treatment designed to thin the crown and promote regeneration. Approximately 160 acres would receive a treatment designed to maintain sufficient large trees to provide old stand attributes, and 230 acres of Lynx Habitat would receive a modified shelterwood treatment that would target retaining $\geq$40% crown closure in all tree size classes. Collectively these treatments would reduce habitat quality for those species relying on mature, closed-canopied forested habitats. However roughly 301 of those acres could provide lower-quality habitats for those species requiring mature, forested conditions more quickly than stands receiving regeneration-type treatments, due, to the anticipated tree retention levels. In general, habitats for those species adapted to more-open forest conditions would increase in the Project Area, while habitats for wildlife species that prefer dense, mature forest conditions would be further reduced in the Project Section. Alterations to existing habitats could alter animal movements in the Project Section. However project layout that would retain connected patches of forested cover, particularly along the ridge, and prescriptions that would target retaining $\geq$40% crown closure in all tree size classes in a sizeable portion of the Project Section would continue to facilitate animal movements through the Project Section. Thus a minor risk of adverse direct and indirect effects to mature forested habitats and connectivity would be expected since:

1. Harvesting would create more open stands on 370 acres, including roughly 352 acres of mature forested habitats.

2. Alterations to connected, forested habitats would not appreciably alter potential animal movements through the Project Section.
3. Some changes to wildlife use would be expected.

4.10.1.4 Alternative B: Harvest, Cumulative Effects to Mature Forested Habitats and Landscape Connectivity

Modifications to mature, forested habitats associated with this alternative would be additive to losses associated with past harvesting activities. Stands in the Project Section would be thinned which could alter some animal movements, but connectivity would be retained. No appreciable changes in the suitability of the cumulative effects analysis area to facilitate wildlife movement would be anticipated given the prescriptions in the Project Section and the surrounding mosaic of habitats in the cumulative effects analysis area. Habitats for forested interior species and old-stand-associated species, such as the American marten, northern goshawk, and pileated woodpecker, would be reduced. Thus, a minor-moderate risk of adverse cumulative effects to mature forested habitats and connectivity would be expected since:

1. Harvesting would alter additional mature stands, further reducing those attributes in a landscape where they have been reduced considerably in the past.
2. Landscape connectivity would be altered, but past management has already compromised connectivity in the area.
3. Some changes to wildlife use would be expected.

4.10.2 Endangered Species

4.10.2.1 Grizzly Bears

4.10.2.1.1 Alternative A: No Action, Direct and Indirect Effects to Grizzly Bears

No direct or indirect effects to grizzly bears would be anticipated since:

1. No disturbance or displacement would be expected.
2. No appreciable changes in hiding cover would occur.
3. Security habitat would not be altered.
4. No changes in long-term open-road densities would be anticipated.

4.10.2.1.2 Alternative A: No Action, Cumulative Effects to Grizzly Bears

No appreciable changes to existing habitats would be anticipated; advances in succession within those recently harvested stands could improve hiding cover and

potentially foraging habitats for grizzly bears. Thus, no further adverse cumulative effects to grizzly bears would be anticipated since:

1. No changes in human disturbance levels would be expected.
2. No changes to open road density would occur.
3. No further modifications to hiding cover would occur.
4. No changes to security habitats would be expected.

4.10.2.1.3 Alternative B: Harvest, Direct and Indirect Effects to Grizzly Bears

This alternative might affect grizzly bears directly through increased road traffic, noise, and human activity, and indirectly by altering the amount of hiding cover and forage resources. Activities in grizzly bear habitats reduce grizzly bear security, possibly resulting in increased stress and/or energy expenditure to endure the disturbance or to move from the area. These disturbances would only be present during harvesting operations; therefore, the season of disturbance is important in addressing effects to grizzly bears. Some disturbance of grizzly bears would be possible with any activities that may occur during the non-denning period; proposed harvesting would likely occur during the non-denning period. Overall, the proposed harvest activities would occur in areas where low levels of grizzly bear use would be anticipated, leading to minor disturbance and displacement of grizzly bears.

Hiding cover, defined as vegetation that will hide 90 percent of a grizzly bear at a distance of 200 feet, would be reduced on roughly 370 acres. Some hiding cover in the form of brush, shrubs, and sub-merchantable trees would persist in several of the harvest units, albeit at a reduced level from the existing condition; hiding cover would increase through time as young trees and shrub regeneration proceeds over the next 5 to 10 years. No changes to security habitats would occur.

Approximately 5.1 miles of new, restricted roads would be constructed with the proposed activities. No changes in open road density or motorized public access would be anticipated. Some increases in non-motorized human access could occur on the newly constructed roads. Thus, a minor risk of adverse direct or indirect effects to grizzly bears would be anticipated since:

1. Minor disturbance and displacement would be anticipated.
2. Hiding cover would be reduced in a portion of the Project Section, but would remain in portions of the Project Section, and would be expected to recover in the short-term.
3. No changes to security habitats would be expected.
4. No changes to long-term open road density would be anticipated.

4.10.2.1.4 Alternative B: Harvest, Cumulative Effects to Grizzly Bears

The increased use of road systems during the proposed harvest activities could temporarily increase human disturbance to grizzly bears within a portion of the cumulative effects analysis area. Collectively, short-term (2-4 years) increases in human disturbance would be anticipated in the cumulative effects analysis area. Continued use of the cumulative effects analysis area by grizzly bears would be anticipated at levels similar to present. Reductions in hiding cover would be additive to the reductions from past timber harvesting, ongoing harvesting, as well as more permanent land-cover changes in the cumulative effects analysis area. Development of early successional stages of vegetation within Proposed Harvest Areas (post-harvest) could provide additional foraging opportunities. No changes in long-term open-road density would be anticipated; an increase in non-motorized access to a small portion of the cumulative effects analysis area would occur. Thus, a minor risk of adverse cumulative effects to grizzly bears would be anticipated since:

1. Increases in human disturbance levels in the short-term would be expected within a small portion of the cumulative effects analysis area.
2. Hiding cover would be removed in the short-term on a small portion of the cumulative effects analysis area.
3. No changes in long-term open road density would occur.
4. No changes to security habitats would be expected.

4.10.2.2 Lynx

4.10.2.2.1 Alternative A: No Action, Direct and Indirect Effects to Lynx

In the short-term, no changes in lynx habitat elements would be expected in the Project Section. In the longer-term, barring any major natural disturbances, natural succession would advance several classes of lynx habitats forward, generally improving several classes of lynx habitats; however, summer foraging habitats would continue to be a minor component of the Project Section and would gradually transition into either winter foraging or other suitable habitats. Winter foraging habitats would be expected to remain at similar levels, or increase in the future, as shade-tolerant trees develop in the understory and coarse woody debris accumulates through time due to natural events. Landscape connectivity would not be altered. Thus, a negligible risk of adverse direct and indirect effects to Canada lynx would be expected since:

1. Existing winter foraging habitats would persist.
2. Summer foraging habitats would gradually disappear without disturbance.
3. The amount of temporary non-suitable habitats would not increase.

4. Landscape connectivity would not be altered.

4.10.2.2.2 Alternative A: No Action, Cumulative Effects to Lynx

No appreciable change in lynx habitats in the cumulative effects analysis area would occur, except the continued maturation of stands. Winter foraging habitats would be expected to improve in the future as shade-tolerant trees continue to develop in the understory, coarse woody debris accumulates through time due to natural events, and, in general, stands continue maturing out of summer foraging and other suitable habitats. No appreciable changes to landscape connectivity would be anticipated. Thus, a negligible risk of adverse cumulative effects to lynx would be expected since:

1. Winter foraging habitats would persist in the cumulative effects analysis area.
2. Summer foraging habitats would continue developing in the near-term across the cumulative-effects analysis area, but longer-term availability of summer foraging habitats would likely decline without disturbance.
3. No changes in the amount of the cumulative-effects analysis area that is in the temporary non-suitable habitat class would occur.
4. Landscape connectivity would not be altered.

4.10.2.2.3 Alternative B: Harvest, Direct and Indirect Effects to Lynx

Approximately 230acres of lynx habitats (204acres winter foraging habitats, 25 acres other suitable habitats, and 1 acre summer foraging habitats) would be harvested with this alternative. These areas would all receive a modified shelterwood treatment that would target retaining $\geq$40% crown closure in all tree size classes. Across all 230acres of lynx habitats, canopy cover and horizontal cover would be reduced to prepare for regenerating trees, which would reduce the quality of the lynx habitats in the short-term. Despite these prescriptions, up to 86 acres of winter foraging, 4 acres of other suitable, and 1 acre of summer foraging habitats would likely drop below the 40% canopy closure threshold that differentiates between suitable and temporary non-suitable habitats due to harvesting corridors, skid trails, damage to sub-merchantable trees, landings, and low original stand density. Some additional acreage of lynx habitats would be converted to permanently unsuitable with the road construction. Thus roughly 26% of the lynx habitats in the Project Section would be converted to temporary non-suitable habitats, 35% of lynx habitats would be altered, but would continue functioning as suitable lynx habitats, and 39% would not be altered with the proposed activities. In the future as tree seedlings and shrubs recover in these stands, they would begin providing additional habitats for snowshoe hares. The retention of patches of advanced regeneration of shade-tolerant trees, such as subalpine-fir, would break-up sight distances, provide horizontal cover, and provide forest structural attributes preferred by snowshoe hares and lynx. In all

Proposed Harvest Areas, coarse woody debris would be retained (emphasizing retention of some logs 15 inches dbh and larger) to provide some horizontal cover and security structure for lynx. In the short-term, lynx use of the Project Section could decline due to the resulting openness on a portion of the Project Section. Forested connectivity would be altered with the proposed activities, but overall connectivity would be retained. Collectively, a minor risk of adverse direct and indirect effects to Canada lynx would be expected since:

1. Some winter foraging habitats could be reduced.
2. Negligible changes to summer foraging habitats would occur, and some future summer foraging habitats could be created.
3. The amount of the Project Section in the temporary non-suitable lynx habitat category would increase to roughly 26%.
4. Connectivity could be altered, but corridors would be maintained.

4.10.2.2.4 Alternative B: Harvest, Cumulative Effects to Lynx

Within the cumulative-effects analysis area, lynx habitats would continue to persist. Reductions in winter foraging, summer foraging, and other suitable habitats coupled with an increase in temporary non-suitable habitats on the portions of the cumulative effects analysis area managed by DNRC could slightly decrease the quality of the lynx habitats in the cumulative effects analysis area. Near-term increases in summer foraging habitats would be anticipated with the proposed harvesting within a portion of the cumulative effects analysis area, however, summer foraging habitats are fairly common in the cumulative effects analysis area. Anticipated reductions in lynx habitats would be additive to past losses from timber harvesting and any ongoing modifications in the cumulative-effects analysis area; likewise, increases in temporary non-suitable lynx habitats would be additive to habitats that have been recently converted due to timber harvesting. A minor amount (9%) of the DNRC-managed lands in the cumulative effects analysis area would be in the temporary non-suitable lynx habitats, meaning most of the lynx habitats would be in a usable state for lynx. Forest connectivity would be modified in the Project Section, but negligible changes to connectivity across the cumulative effects analysis area would be anticipated. Thus, a minor risk of adverse cumulative effects to Canada lynx would be expected since:

1. Adequate winter foraging habitats would persist.
2. Summer foraging habitats would continue developing for the next 10 to 30 years.
3. Minor amounts of lynx habitats would be in the temporary non-suitable habitat category, meaning most of the lynx habitats would be in a usable state for lynx.
4. Negligible alterations in landscape connectivity would not prevent lynx movements.

4.10.3 Sensitive Species:

4.10.3.1 Fisher

4.10.3.1.1 Alternative A: No Action, Direct, and Indirect Effects to. Fisher
Minimal changes to the stands providing fisher habitats would be expected. Habitats that are conducive to fisher denning and travel may improve in time due to increases in tree growth and canopy closure. No direct and indirect effects would affect fishers in the Project Area since:

1. No changes to existing habitats would be anticipated.
2. Landscape connectivity would not be altered further.
3. No appreciable changes to snags, snag recruits, and coarse woody debris levels would be anticipated.
4. No changes to human access or the potential for trapping mortality would be anticipated.

4.10.3.1.2 Alternative A: No Action, Cumulative Effects to Fisher
No further cumulative effects to fishers would be anticipated in the cumulative-effects analysis area since:

1. No changes to existing habitats on DNRC-managed land would occur.
2. Any landscape connectivity afforded by the stands on DNRC-managed lands would not change appreciably.
3. No changes to snags, snag recruits, or coarse woody debris levels would be expected.
4. No changes to human access or the potential for trapping mortality would be anticipated.

4.10.3.1.3 Alternative B: Action, Direct, and Indirect Effects to. Fisher
No riparian habitats would be altered with this alternative. Approximately 27 of the 43 acres (62.8%) of upland fisher habitats in the Project Section would receive treatments. The majority of this acreage would receive a modified shelterwood treatment that would target retaining ≥40% crown closure in all tree size classes, which would maintain the area as potential upland fisher habitats. No changes in open roads would be anticipated, which would not likely alter trapping pressure and the potential for fisher mortality. Some alterations to landscape connectivity could occur, but proposed activities would retain sufficient structure to facilitate fisher movements, and would avoid riparian areas used by fisher. Thus, a minor risk of adverse direct and indirect effects to fisher would be anticipated since:

1. Harvesting would avoid riparian areas.

2. Harvesting would reduce or remove upland fisher habitats.
3. Minor alterations to landscape connectivity would occur, but those areas associated with riparian areas would remain unaffected.
4. Harvesting would reduce snags and snag-recruitment trees while increasing coarse woody debris levels; however, some of these resources would be retained.
5. No appreciable changes in motorized human-access levels would be anticipated.

4.10.3.1.4 Alternative B: Action, Cumulative Effects to. Fisher

Approximately 27 acres of potential upland fisher foraging and travel habitats would be harvested; prescriptions would reduce habitat quality on those acres, but would retain sufficient overstory to be considered fisher habitat following proposed treatment. Thus no changes in the availability of riparian or upland foraging and travel habitats on DNRC-managed lands in the cumulative effects analysis area or other ownerships in the larger cumulative-effects analysis area would occur. Negligible alterations to landscape connectivity would be anticipated, with activities avoiding riparian areas commonly used by fisher. No appreciable changes in human disturbance and potential trapping mortality would be anticipated. Thus, a minor risk of adverse cumulative effects to fisher would be anticipated since:

1. Harvesting would alter upland fisher habitats, but would maintain sufficient canopy closure to continue to be potential fisher habitats.
2. Minor changes in landscape connectivity would be anticipated, but connectivity in riparian areas would not be altered.
3. Harvesting in a relatively small portion of the cumulative-effects analysis area would partially reduce snags and snag recruits, while increasing the coarse woody debris levels, largely in the smaller-sized pieces.
4. No appreciable changes to motorized human access would occur.

4.10.3.2 Flammulated Owls

4.10.3.2.1 Alternative A: No Action, Direct, and Indirect Effects to Flammulated Owls

Existing flammulated owl habitats in the Project Section would persist. With advancing succession, stands could continue to become densely stocked and exist at high risk to insects, disease and stand-replacement fire. Therefore, habitat sustainability and quality for flammulated owls would continue to decline. Thus,

a negligible risk of adverse direct and indirect effects to flammulated owls would be anticipated since:

1. No harvesting would occur.
2. No changes to potential nesting habitats would be anticipated.
3. Long-term, succession-related declines in foraging habitats coupled with advancing succession leading to denser stands.

4.10.3.2.2 Alternative A: No Action, Cumulative Effects to Flammulated Owls

Existing flammulated owl habitats would persist. Recent timber management across the cumulative effects analysis area has potentially improved flammulated owl habitats by creating foraging habitats and reversing a portion of the Douglas-fir encroachment, however retention of large ponderosa pine and/or Douglas-fir was not necessarily a consideration in some of these previously harvested areas, thereby minimizing the benefits to flammulated owls. Areas exhibiting mature forested conditions would be expected to persist and could provide flammulated owl nesting habitats into the future. Thus, a negligible risk of adverse cumulative effects to flammulated owls would be anticipated since:

1. No harvesting would occur.
2. No changes to potential nesting habitats would be anticipated.
3. Long-term, succession-related declines in foraging habitats coupled with advancing succession leading to denser, less suitable foraging conditions.

4.10.3.2.3 Alternative B: Harvest, Direct, and Indirect Effects to Flammulated Owls

Flammulated owls are tolerant of human disturbance (McCallum 1994), however the elevated disturbance levels associated with harvesting could negatively affect flammulated owls should they be using existing habitat during proposed activities. proposed timber harvest on 137 acres of flammulated owl habitat (64.6% of the habitats in the Project Section) would open the canopy while favoring western larch, ponderosa pine, and Douglas-fir. Elements of the forest structure important for nesting flammulated owls, including snags, coarse woody debris, numerous leave trees, and snag recruits would be retained in the Proposed Harvest Areas. The subsequent regeneration in much of the existing habitats would likely be beneficial for flammulated owls as potential foraging habitats. The more open stand conditions, the retention of fire adapted tree species, and the maintenance of snags would move the Project Section toward historical conditions, which is preferred flammulated owl habitat. Thus, a minor risk of positive direct and indirect effects would be expected to flammulated owls since:

1. Harvesting would open denser stands up.

2. Elements of forest structure used for foraging and nesting by flammulated owl would be retained.
3. Prescriptions would lead to more open stands with scattered (trace amounts of) mature ponderosa pine.

4.10.3.2.4 Alternative B: Harvest, Cumulative Effects to Flammulated Owls

The proposed harvesting would increase the amount of the cumulative effects analysis area that has been recently harvested, which would add to the amount of foraging habitats available, but possibly at the expense of nesting habitats. Foraging habitats are quite abundant in the cumulative effects analysis area due to past harvesting, and the maintenance of nesting structures would benefit flammulated owls using the cumulative effects analysis area. The portions of the cumulative-effects analysis area not currently providing flammulated owl habitats would not be expected to change any time in the future. Collectively, stands across the cumulative effects analysis area would continue maturing and becoming more densely stocked, which would reduce habitat quality for flammulated owls. Thus, a negligible risk of beneficial cumulative effects to flammulated owls would be expected since:

1. Harvesting would improve the quality and sustainability of flammulated owl habitat on a small number of acres.
2. A small increase in the amount of the cumulative-effects analysis area would be more representative of historic conditions.

4.10.3.3 Pileated Woodpeckers

4.10.3.3.1 Alternative A: No Action, Direct and Indirect Effects to Pileated Woodpeckers

No disturbance of pileated woodpeckers would occur. Forest succession and natural disturbance agents would continue to bring about changes in existing stands. Thus, a negligible risk of adverse direct and indirect effects to pileated woodpeckers would be expected since:

1. No further harvesting would occur.
2. No changes in the amount of continuously forested habitats would be anticipated.
3. No appreciable changes to existing pileated woodpecker habitats would be anticipated.
4. Long-term, succession-related declines in the abundance of shade-intolerant tree species, which are valuable to pileated woodpeckers, would be anticipated.

4.10.3.3.2 Alternative A: No Action, Cumulative Effects to Pileated Woodpeckers

No disturbance of pileated woodpeckers would occur. Continued use of the cumulative-effects analysis area by pileated woodpeckers would be expected at similar levels as presently occurring. Thus, a negligible risk of adverse cumulative effects to pileated woodpeckers would be expected since:

1. No further changes to existing habitats would occur.
2. No further changes to the amount of continuously forested habitats available for pileated woodpeckers would be anticipated.
3. Long-term, succession-related changes in the abundance of shade-intolerant tree species, which are valuable to pileated woodpeckers, would occur.

4.10.3.3.3 Alternative B: Harvest, Direct and Indirect Effects to Pileated Woodpeckers

Pileated woodpeckers tend to be tolerant of human activities (Bull and Jackson 1995), but might be temporarily displaced by any Proposed Activities that may occur during the nesting period. Harvesting would reduce continuously-forested habitats for pileated woodpeckers. Approximately 295 acres (67.7%) of the potential nesting habitat would be modified as well as 76 acres (38.6%) of potential foraging habitats. Approximately 212 of the 295 acres (71.9%) of nesting habitats and 22 of the 76 acres (28.9%) of foraging habitats would receive a modified shelterwood treatment that would target retaining $\geq$40% crown closure in all tree size classes. The quality of these habitats would be reduced, but they would likely continue to function as they are presently. The remaining 83 acres of nesting habitats and 54 acres of foraging habitats would be temporarily unsuitable for pileated woodpeckers due to the openness of the stands following proposed treatments. Potential pileated woodpecker habitats would be reduced for 30-100 years, depending on the density of trees retained. Elements of the forest structure important for nesting pileated woodpeckers, including snags, coarse woody debris, numerous leave trees, and snag recruits would be retained in the Proposed Harvest Areas. Since pileated woodpecker density is positively correlated with the amount of dead and/or dying wood in a stand (McClelland 1979), pileated woodpecker densities in the Project Section would be expected to be reduced on 370 acres. The silvicultural prescriptions would retain healthy western larch, ponderosa pine, and Douglas-fir while promoting the growth and/or regeneration of many of these same species, which would benefit pileated woodpeckers in the future by providing nesting, roosting, and foraging habitats. Thus, a minor risk of adverse direct and indirect effects to pileated woodpeckers would be anticipated since:

1. Harvesting would reduce the amount of continuous-forested habitats available.

2. Some potential nesting habitats and foraging habitats would be removed, but the majority would be retained, but the quality would be reduced.
3. Snags and snag recruits would be removed; however, mitigation measures to retain a minimum of 1-2 snags and snag recruits per acre would be included.
4. Proposed treatments would promote seral species in the Project Section.

4.10.3.3.4 Alternative B: Harvest, Cumulative Effects to Pileated Woodpeckers

Minor changes in pileated woodpecker habitats and further reductions in the amount of continuously forested habitats available for pileated woodpeckers would occur. Several snags and snag recruits per acre including potential nesting trees (live trees, especially large diameter trees with extensive rot evident by conks, cavities and or broken boles) and coarse woody debris would be retained in the Project Section; however, future recruitment of these attributes may be reduced in a portion of the area as a result of the proposed harvest activities. The loss of pileated woodpecker habitats along with the reductions in quality of existing habitats would be additive to habitat losses associated with past harvesting. Collectively, the reductions in quality and quantity of pileated woodpecker habitats along with the modifications to continuously forested habitats could alter habitats to the point that the cumulative effects analysis area may no longer support a pair of pileated woodpeckers. Continued maturation of stands across the cumulative-effects analysis area would provide future pileated woodpecker habitats. Thus, a moderate risk of adverse cumulative effects to pileated woodpeckers would be anticipated since:

1. Harvesting would further reduce the amount of continuous forested habitats available in the cumulative-effects analysis area.
2. Potential nesting and foraging habitats would be reduced, but some habitats would persist in the cumulative-effects analysis area.
3. Snags and snag recruits would be removed; however, mitigation measures would retain some of these attributes.
4. Proposed treatments would promote seral species in the Project Section.

4.10.4 Big Game

4.10.4.1 Big Game Winter Range

4.10.4.1.1 Alternative A: No Action, Direct and Indirect Effects to Big Game Winter Range

No direct or indirect effects to big game winter range would be anticipated since:

1. Subtle changes in thermal cover due to mortality and successional advances increasing canopy densities would be anticipated.
2. The amount of mature forested habitats on the winter range would not change appreciably.
3. The levels of human disturbance would remain similar.

4.10.4.1.2 Alternative A: No Action, Cumulative Effects to Big Game Winter Range

Continued winter use of the larger winter range would be expected. No further changes in thermal cover and snow intercept would be anticipated. Human disturbance levels would be anticipated to continue at similar levels. Thus, a minor risk of positive cumulative effects to big game winter range would be anticipated since:

1. Subtle changes in thermal cover due to advances in succession that would increase canopy densities would be anticipated over time.
2. The amount of mature forested habitats on the winter range would not change.
3. The levels of human disturbance would remain similar.

4.10.4.1.3 Alternative B: Action, Direct and Indirect Effects to Big Game Winter Range

Some displacement would be expected as a result of the proposed harvest activities if they were conducted during the winter period; winter logging would be unlikely in the Project Section given the elevation and distance from maintained (snow plowed) county roads. The proposed activities would reduce overstory stocking on 168 of the 293 (57.3%) acres in the winter range. This resultant affected area would be largely too open to function as thermal cover or snow intercept, thus eliminating habitat attributes that would enable concentrated winter use by deer and elk. These losses of thermal cover and snow intercept would require 40-60 years for suitable sized trees (>40 ft. tall) to develop post-harvest. The proposed timber harvest would not prevent big game movement through the Project Section in winter and could stimulate browse production within the harvested areas. Thus, a moderate risk of adverse direct or indirect effects to big game winter range would be expected since:

1. Reductions in thermal cover and snow intercept would occur.
2. A high percentage of the mature forested habitats on the winter range would be altered.

3. Disturbance to big game using the winter range would be minimized due to the low likelihood of activities occurring in the winter period coupled with the relatively short-term that logging activities could create disturbance in this area.

4.10.4.1.4 Alternative B: Action, Cumulative Effects to Big Game Winter Range

Disturbance or displacement of big game would be unlikely with this alternative given the elevation of the Project Section, habitats present, habitats on surrounding ownerships, the small amount of the cumulative effects analysis area potentially affected, and low-likelihood that activities would occur during the winter period. Thermal cover and snow intercept would be largely removed from approximately 168 acres of 3,797-acre winter range, further reducing the amount of the winter range that appears to be providing these resources to approximately 534 acres; reductions would be additive to ongoing and past reductions across the winter range. Portions of the winter range are expected to start providing some habitat attributes suitable for winter big game use in the near future as they continue maturing with time. Thus, a minor risk of adverse cumulative effects to big game winter range would be anticipated since:

1. There would be a low potential for disturbance or displacement of wintering big game.
2. A small percentage of the winter range would be altered.
3. Availability of cover on surrounding ownerships that provides some opportunity for deer should they be displaced.

4.10.4.2 Elk Security Habitat

4.10.4.2.1 Alternative A: No Action, Direct and Indirect Effects to Elk Security Habitat

No risk of adverse indirect effects to elk security habitats would be expected since:

1. No changes in existing elk security habitats would be anticipated and continued maturation of forest cover would improve elk security habitats.
2. The level of human access to the Project Area would not change.
3. No appreciable changes to big game survival would be anticipated.

4.10.4.2.2 Alternative A: No Action, Cumulative Effects to Elk Security Habitat

No changes in elk security habitat would be anticipated. Past harvesting reduced elk security habitats and allowed increased human access; continued maturation in

previously harvested stands in the cumulative-effects analysis area would improve hiding cover in those areas. No other changes in disturbance and potential mortality due to hunting would be anticipated. Thus, a minor risk of positive cumulative effects to elk security habitats would be anticipated since:

1. No changes in open roads, motorized access, or human access would be anticipated.
2. No reductions in elk security habitat would occur.
3. Modest levels of security habitat and hiding cover would persist within the cumulative-effects analysis area.
4. No appreciable changes to big game survival would be anticipated.

4.10.4.2.3 Alternative B: Harvest, Direct and Indirect Effects to Elk Security Habitat

No changes in open roads or motorized access for the general public would occur. During all phases of the proposed harvest activities, any roads opened would be restricted to the public and closed after the completion of project activities. Proposed new roads would be restricted to the public, but could facilitate non-motorized access during the hunting season using mountain bikes, horses, and/or foot travel. The proposed harvesting would reduce some of the hiding cover in the short-term, while increasing sight distances; however hiding cover would improve rapidly as trees and shrubs become reestablished. The retention of structure and un-harvested areas between the various units would reduce the potential effects of the hiding cover reductions. Overall, increased sight distances and the modification of hiding cover may slightly increase elk vulnerability risk in the Project Section. Collectively, a minor risk of adverse effects to elk security habitats would be anticipated since:

1. No changes in open roads or motorized access for the general public would be anticipated.
2. Minor increases in non-motorized access could increase hunter access.
3. Modifications to existing hiding cover would reduce the quality of the elk security habitats in the Project Section.
4. Negligible changes in big game survival would be anticipated.

4.10.4.2.4 Alternative B: Harvest, Cumulative Effects to Elk Security Habitat

No changes in public, motorized access and negligible increases in non-motorized access would be expected, which would not affect elk vulnerability in the cumulative effects analysis area. Alterations of cover could reduce the quality of elk security habitats in a small portion of the cumulative effects analysis area. Continued maturation across the cumulative-effects analysis area would improve hiding cover and elk security habitats. Negligible impacts to big game survival

would be anticipated. Thus, a minor risk of adverse cumulative effects to elk security would be anticipated since:

1. No changes in open roads or motorized access for the general public would be expected.
2. Quality of hiding cover in a small portion of the cumulative effects analysis area would be reduced, which would reduce the quality of the elk security habitats.
3. Security habitat and hiding cover would persist in the cumulative-effects analysis area.
4. Negligible changes in big game survival would be anticipated.

4.11 Cumulative effects of other Missoula Unit DNRC: Timber Sales, Projects or Activities:

Timber Sales listed below in Table 4.11 have or would affect classified forest land habitats including its attributes. This is the extent to which they are related to the Action Alternative B: Harvest. The Existing Condition of classified forest lands (discussed in Vegetation Chap.3.5, used SLI Data 1-12-2011) is the sum of effects resulting from timber sales listed below shown to be completed 2011. Cumulative effects to classified forest habitats are discussed in Chap.4.5.4. **Changes to Land Base:** The Lolo Land Exchange was completed December 2010; the Missoula Unit DNRC consolidated some of its land base by exchanging approximately 10,530 acres for 12,138 acres of United States Forest Service Lands. The Potomac Lands Acquisition was completed November 2010; the DNRC purchased 32,210 acres from The Nature Conservancy, lands previously owned by Plum Creek Timber Company. These lands are managed by Missoula Unit DNRC. **Improvements to fish habitat:** DNRC Ashby Creek Road Relocation Project implemented 2012.

Table 4.11: OTHER DNRC MISSOULA UNIT TIMBER SALES

Timber Sale Name:	Air miles from Kamas Point	Year(s) implemented or Status	Predominant Harvest Treatment
Turah Creek	18	Completed 2005	Commercial Thinning
Cramer Creek	4	Completed 2005	Shelterwood
Tyler Creek	12	Completed 2007	Shelterwood
Davis Point	26	Completed 2007	Overstory removal
Dirty Ike Fire Salvage	11	Completed 2004	Salvage
St. Regis Beetle	84	Completed 2004	Commercial Thinning
St. Regis Cable	82	Completed 2006	Commercial Thinning
Fish Creek Fire Salvage	59	Completed 2005	Salvage
Deadman	32	Completed 2007	Commercial Thinning
Fournier Creek Fire Salvage	38	Completed 2009	Salvage
Starving Cramer Fire Salvage	10-12	Completed 2008	Salvage
Roman-Six Mile	20	Completed 2009	Commercial Thinning
Timber Creek	101	Completed 2009	Shelterwood
Packer Gulch Fire Salvage	8	Completed 2010	Salvage
Dry Gulch	7	Completed 2010	Shelterwood
Gambler's Secret	4-10	Completed 2011	Shelterwood
Deer Creek	22	Completed 2012	Shelterwood
Tarkio II	55	Sold 2011-2014	Commercial Thinning
Four Mile	68	Sold: 2012-2015	Shelterwood
McNamara Landing	10	Sold: 2012-2014	Shelterwood
Washoe Creek	7	Sold: 2012-2014	Shelterwood
West Fork Timber Creek	101	Proposed: sell 2013	Shelterwood
Rivulet Peak	57	Proposed: sell 2013	Shelterwood
Heyer's Gulch	8	Proposed: sell 2014	Shelterwood-seed tree

5.0 List of Individuals Associated with the Project

Jonathan Hansen	Decision Maker/ Unit Manager, Missoula Unit, SWLO, DNRC
Preparers of:	Environmental Assessment including analysis, mitigations design, Project development, design criteria, harvest and transportation systems design.
Garrett Schairer	Wildlife Biologist, SWLO, DNRC
Gary Frank	Hydrologist, Forest Management Bureau, DNRC
Richard D. Stocker	Project Leader/ Forester- Timber Sale Specialist, Missoula Unit, SWLO, DNRC

6.0 List of Agencies and Persons Consulted and or Provided Copies of this EA

Consulted:
Patrick Rennie -Archeologist, AGMB, DNRC, Helena

EA provided to:

1) Fish, Wildlife and Parks (FWP), Missoula, Montana (DNRC routinely provides EA's to FWP).
2) Department of Environmental Quality (DEQ). EAs routinely filed with DEQ.
3) DNRC Staff (SWLO and FMB), including ID Team members.
4) DNRC Website (copy of EA posted on DNRC website, minimum 30 day period) http://dnrc.mt.gov/EnvironmentalDocuments/Default.asp
5) Environmental Quality Council (EQC). EAs routinely filed with EQC. Website: http://leg.mt.gov/css/Publications/MEPA/mepa.asp

Requests for EA:
None

7.0 References

Wildlife:

Literature Cited

Aney, W. and R. McClelland. 1985. Pileated Woodpecker Habitat Relationships (revised). Pages 10-17 in Warren, N. eds. 1990. Old Growth Habitats and Associated Wildlife Species in the Northern Rocky Mountains. USFS, Northern Region, Wildlife Habitat Relationships Program R1-90-42. 47pp.

Bull, E. L., and J. A. Jackson. 1995. Pileated woodpecker: Dryocopus pileatus. American Ornithologists' Union. Washington DC. 24pp.

Buskirk, S.W., and R.A. Powell. 1994. Habitat ecology of fishers and American martens. Pages 283-296 *in* Buskirk, S.W., A. Harestad, M. Raphael, eds. Biology and conservation of martens, sables and fishers. Cornell University Press, Ithaca, NY.

DNRC. 2011. Washoe Creek Timber Sale Environmental Assessment. DNRC Forest Management Bureau, Missoula, Montana.

Foresman, K.R.. 2001. The wild mammals of Montana. Special Publication 12. American Society of Mammalogists. Allen Press, Kansas. 278pp.

Heinemeyer, K. S., and J. L. Jones. 1994. Fisher biology and management in the western United States: A literature review and adaptive management strategy. USDA Forest Service, Northern Region, Missoula, Montana. 108pp.

Hillis, J.M., and M.J. Thompson, J.E. Canfield, L.J. Lyon, C.L. Marcum, P.M. Dolan, and D.W. McCleerey. 1991. Defining elk security: the Hillis paradigm. Pages 38-43 in A.G. Christensen, L.J. Lyon, and T.N. Lonner, comps., Proc. Elk Vulnerability Symp., Mont. State Univ., Bozeman, Montana. 330pp.

Johnson, S. 1984. Home range, movements, and habitat use of fishers in Wisconsin. M.S. Thesis, University Wisconsin, Stevens Point. 78pp.

Jones, J.L. 1991. Habitat use of fisher in north-central Idaho. M.S. Thesis, University of Idaho, Moscow, Idaho. 147 pp.

Mace, R.D., and J.S. Waller. 1997. Final Report: Grizzly bear ecology in the Swan Mountains, Montana. Montana Fish, Wildlife and Parks, Helena, Montana. 191pp.

Mace, R.D., J.S. Waller, T.L. Manley, L.J. Lyon, and H. Zuuring. 1997. Relationships among grizzly bears, roads, and habitat in the Swan Mountains, Montana. Pages 64-80 *in* Mace, R.D., and J.S. Waller. 1997. Final Report: Grizzly bear ecology in the Swan Mountains, Montana. Montana Fish, Wildlife and Parks, Helena, Montana. 191pp

McCallum, D. A. 1994. Review of technical knowledge: flammulated owls. Pages 14-46 *in* G. D. Hayward and J. Verner, tech eds. Flammulated, boreal, and great gray owls in the United States: a technical conservation assessment. USDA Forest Service Gen. Tech. Rep. RM-253. Fort Collins, Colorado.

McClelland, B.R. 1979. The pileated woodpecker in forests of the Northern Rocky Mountains. Pages 283-299 *in* Role of insectivorous birds in forest ecosystems. Academic Press.

Pfister, R., B. Kovalchik, S. Arno, and R. Presby. 1977. Forest Habitat Types of Montana. USDA Forest Service General Technical Report INT-34. Intermountain Forest and Range Experiment Station Ogden, UT. 174pp.

Powell, R. 1982. The fisher: National history, ecology, and behavior. University of Minnesota Press, Minneapolis, Minnesota. 217pp.

Powell, R. A. and W. J. Zielinski. 1994. Fisher. Pages 38-73 in Ruggiero, L. F., K. B. Aubry, S. W. Buskirk, L. J. Lyon, and W. J. Zielinski, tech eds. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. USDA Forest Service Gen. Tech. Rep. RM-254. Fort Collins CO.

Ruediger, B., J. Claar, S. Mighton, B. Nanaey, T. Tinaldi, F. Wahl, N. Warren, D. Wenger, A. Williamson, L. Lewis, B. Holt, G. Patton, J. Trick, A. Vandehey, and S. Gniadek. 2000. Canada Lynx Conservation Assessment (2nd Edition). USDA Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management, and USDI National Park Service. Missoula, MT. 122 pp.

Squires, J.R., N.J. DeCesare, J.A. Kolbe, and L. F. Ruggiero. 2010. Seasonal resource selection of Canada lynx in managed forests of the Northern Rocky Mountains. Journal of Wildlife Management 74:1648-1660.

Squires, J. R., N. J. DeCesare, J. A. Kolbe, and L. F. Ruggiero. 2008. Hierarchical den selection of Canada lynx in western Montana. Journal of Wildlife Management 72:1497–1506.

Wittinger, W.T. 2002. Grizzly bear distribution outside of recovery zones. Unpublished memorandum on file at USDA Forest Service, Region 1. Missoula, Montana.2pp.

Vegetation:

Literature cited and other references

Arno, S.F. 1976. The historical role of fire on the Bitterroot National Forest. Res. Pap. INT-187. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah. 29 p.

Arno, S.F.; Brown, J.K. 1991. Overcoming the paradox in managing wildland fire. Western Wildlands. 17(1): 40-46.

Arno, S.F., Smith, H.Y., and Krebs, M.A. 1997. Old growth ponderosa pine and western larch stand structure: influences of pre-1900 fires and fire exclusion. Res. Pap. INT-495. USDA Forest Service, Intermountain Research Station, Ogden, Utah. 20 p.

Dealy, J.E. 1985. Tree basal area as an index of thermal cover for elk. USDA For. Serv. PNW Res. Note PNW-425.

Fischer, W.C., and Bradley, A.F. 1987. Fire Ecology of Western Montana Forest Habitat Types. Gen. Tech. Rep. INT-223. USDA Forest Service, Intermountain Research Station, Ogden, Utah. 95 p.

Green, P., Joy, J., Sirucek, D., Hann, W., Zack, A., and Naumann, B. 1992. Old-growth forest types of the Northern Region. Non-published report on file at the USDA Forest Service Northern Region Office, Missoula, Montana, 59807. 43 p.

Losensky, B.J. 1997. Historical vegetation of Montana. Non-published report on file at the Montana Department of Natural Resources and Conservation, 2705 Spurgin Road, Missoula, Montana, 59804. 100 p.

Negron, J.F.; Schaupp, W.C. Jr.; Gibson, K.E.; Anhold, J.; Hansen, D.; Thier, R.; and Mocettini, P. 1999. Estimating extent of mortality associated with the Douglas-fir beetle in the central and northern Rockies. Western Journal of Applied Forestry Vol. 14, No. 3, p. 121-127.

Pfister, R.D., Kovalchik, B.L., Arno, S.F., and Presby, R.C. 1977. Forest habitat types of Montana. Gen. Tech. Rep. INT-34. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah. 174 p.

Soils and Hydrology:

Literature Cited

DNRC, 1996. State Forest Land Management Plan, Final Environmental Impact Statement. Montana Department of Natural Resources and Conservation, Forest Management Bureau. Missoula, MT.

DNRC, 2009. DNRC Compiled Soil Monitoring Report on Timber Harvest Projects, 1988-2005, 2nd edition. Montana Department of Natural Resources and Conservation, Forest Management Bureau. Missoula, MT.

Graham, R. T., A. E. Harvey, M.F. Jurgensen, T.B Jain, J.R. Tonn and D.S. Page-Dumroese, 1994. Managing coarse woody debris in forests of the Rocky Mountains. USDA Forest Service, Ogden, UT: Intermountain Research Station.

Haupt, H.F., et al. 1974. Forest hydrology Part II: Hydrologic EFfects of Vegetation Manipulation. USDA Forest Service, Region 1. Missoula, Montana.

MDEQ, 2010. Montana 2010 Revised Draft Water Quality Integrated Report. Montana Department of Environmental Quality. Helena, MT. 69p

USDA, Soils Survey of Missoula County Area, Montana. 1995. Natural Resource Conservation Service and Forest Service.